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ABSTRACT

This student activity kit consists of a programmed, self-instructional learning guide and an accompanying instructor's manual for use in teaching trade and industrial education students how to make an adjustable C-clamp. The student guide contains step-by-step instructions in the following areas: basic layout principles; use of a hack saw, file, vise, and tap and die to make thread; use of a table-mounted drill press; and construction of an adjustable C-clamp. Each section contains an instructional objective, a step-by-step explanation and illustration of the given process being addressed, and a checkpoint activity. Included in the instructor's manual are activity goals, instructional objectives, answers to the checkpoints provided in the learning activity manual, duplicating masters of a view fact sheet, drawings, and a student check sheet. (MN)

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T & I – METALWORK, MAKING AN ADJUSTABLE C-CLAMP

Kit No. 603

INSTRUCTOR'S MANUAL

STUDENT LEARNING ACTIVITY MANUAL

State Department of Education
Office of Vocational Education
Prevocational Education
Columbia, South Carolina 29201

CE 034250

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Original Prepared by
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1982

TITLE OF ACTIVITY

Kit No. 603, Metalwork – Making An Adjustable C-Clamp

DURATION

Main Activity – 4 class periods
Follow-Up Activity – 1 to 2 class periods

GOALS

The student will have an understanding of how to measure and lay out a project. The student will also learn the parts of a drill stand, how to use a tap and die, and how to make an adjustable C-Clamp.

INSTRUCTIONAL OBJECTIVES

The student will be able to measure with a metal rule.

The student will learn the parts of and be able to use a hack saw, file and vise.

The student will learn the parts of and be able to use a tap and die to cut threads and a table-mounted drill press.

The student will be able to make an adjustable C-Clamp.

VOCATIONAL CLUSTERS

Trade and Industry

A. Activity Description

The student will read the material on measuring, layout, hack saw, filing, vise, and hand drill.

The student will also read the material on drill stand, and tap and die.

The student will do a project on making an adjustable C-Clamp.

B. Safety

Be careful when using the scribe because it has a sharp point.

Be sure the handle is on the file tightly.

Be sure the vise is clamped securely to work bench.

Be sure metal is clamped tightly in the vise before sawing, filing, drilling, or threading metal.

Wear safety glasses at all times when drilling holes.

Be sure the cord on the electric drill is in good shape.

Remove chuck key from drill before starting drill motor.

Unplug drill when changing bits.

Handle drill bits carefully.

No horse play is allowed.

C. Materials Required

1. Audio Visual Equipment
   None

2. Technical Equipment
   25 metal rules
   5 squares 6" (15.24 cm)
   5 scribes
   5 center punches
   5 hack saws
   5 single cut, smooth files, 8" (20.32 cm)
   5 file handles, wooden
   5 vises, 3" (7.62 cm) jaws
   5 ball peen hammers, 8 oz. (226.8g)
   3 electric drills, 3/8" (.9525 cm)
   3 drill stands
   10 safety glasses
   5 taps, 3/8 - 16
   5 tap handles
   5 dies, 12-24
   5 die handles
   1 file card

3. Expendable Materials
   2 pieces 4" (10.16 cm) long – ¾" x 1" (1.905 cm x 2.54 cm) rectangular stock per student
   2 pieces 5" (12.7 cm) long – 3/8" (.9525 cm) threaded rod per student
   4 nuts per student, 3/8 x 16
   2 pieces 2" (5.08 cm) long, 3/16" (.47625 cm) rod per student
   4 nuts per student, 12-24
   5 hack saw blades
   5 each 3/16, 5/16, 3/8 drill bits

D. Preparation Prior to Class

Order 20 feet (6.096 m) of ¾" x 1" (1.9050 cm x 2.54 cm) rectangular steel.

Order 25 feet (7.6196 m) of 3/8" (.9525 cm) threaded rod.

Order 1 box of 100 nuts (3/8-16) and 1 box of 100 nuts (12-24).

Duplicate Student Check Sheet for each student

Read over Safety Section and be aware of areas where safety rules are used.

E. During Class Sessions

Explain to each class that no one is to do any activity out of sequence. Tell the students to turn to page one of the programmed text for metalwork. Read the instructional objectives, goals, and directions and then start on Instructional Objective I.

Read each step carefully. Check to see that each Check Point is completed and done correctly. The student should adjust to how the programmed text works. Let the students work at a steady pace – not too fast or too slow. See that safety rules are allowed and correct usage of each tool is observed. The main point to remember is to allow NO horseplay or clowning around. It is easy enough to get hurt using hand tools without help from someone else.

F. Follow-Up Activities

1. Have each student complete a VIEW Fact Sheet.
2. Identify in the newspaper job openings as a machinist or metalworker.

MASTERS FOR DUPLICATION

VIEW Fact Sheet
Final drawings of project
Student Check Sheet

ANSWER KEY

Check Point No. I
1. E
2. C
3. A
4. B
5. D

Check Point No. II
1. B
2. A
3. D
4. E
5. C

Check Point No. III
1. C
2. D
3. A
4. B

Check Point No. IV
1. Tang
2. Face
3. Point
4. Edge
5. Need

Check Point No. V
1. Yes
2. Yes
3. No

Check Point No. VI
A. 4
B. 5
C. 6
D. 1
E. 2
F. 3

Check Point No. VII
A. 3
B. 2
C. 1
D. 4
E. 5

Check Point No. VIII
A. 4
B. 3
C. 2
D. 1

Check Point No. IX
A. 3
B. 1
C. 2
D. 4

VIEW FACT SHEET

NAME _____ CLASS _____ OCCUPATION _____

A. List the advantages (good points) of this occupation (job).

B. List the disadvantages (bad points) of this occupation (job).

C. List three things you should know to do this occupation (job).
1.
2.
3.

D. What type of education should you get to be prepared for this occupation (job)?

E. What courses must you take to go into this occupation (job)?

F. What do you think your future in this occupation (job) will be?

G. What wage can you expect in this occupation (job)?

H. What are the working hours of this occupation (job)?

I. To learn more about this occupation (job), write to:

J. Using a scale of 1 to 5, circle the number that measures your interest in this occupation (job) as a possible career.

I don't like it. ← 1 2 3 4 5 → I like it.

STUDENT CHECK SHEET

Check Point No. I

1 _____
2 _____
3 _____
4 _____
5 _____

Check Point No. II

1 _____
2 _____
3 _____
4 _____
5 _____

Check Point No. III

A _____
B _____
C _____
D _____

Check Point No. IV

A _____
B _____
C _____
D _____
E _____

Check Point No. V

1 _____
2 _____
3 _____

Check Point No. VI

A _____
B _____
C _____
D _____
E _____
F _____

Check Point No. VII

A _____
B _____
C _____
D _____
E _____

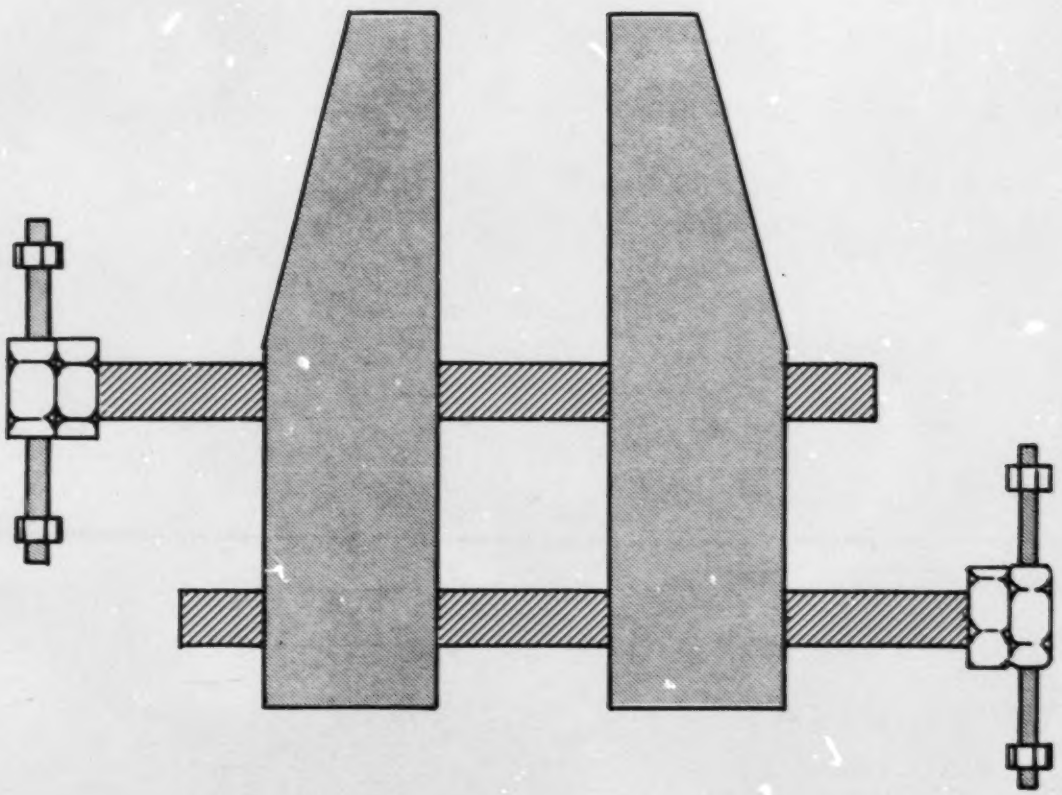
Check Point No. VIII

A _____
B _____
C _____
D _____

Check Point No. IX

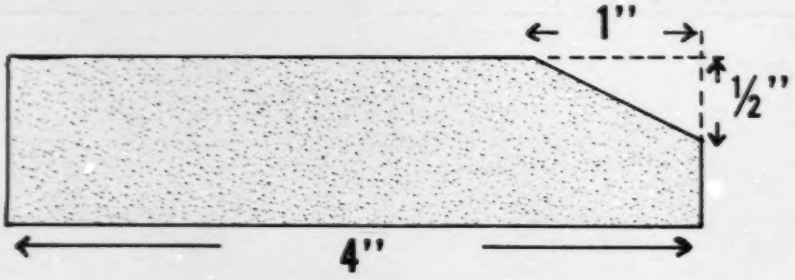
A _____
B _____
C _____
D _____

ASSEMBLED



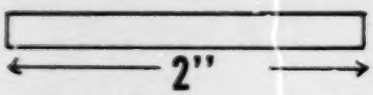
"C" CLAMP

JAWS 2 NEEDED



5/16" THREADED ROD 2 NEEDED

3/16" ROD 2 NEEDED



ALSO (4) 12-24 NUTS

(4) 3/8" NUTS

9

T & I – METAL WORK, MAKING AN ADJUSTABLE C-CLAMP

Kit No. 603

STUDENT LEARNING ACTIVITY MANUAL

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MAKING AN ADJUSTABLE C-CLAMP

INTRODUCTION

In this programmed text, the student will be instructed in basic layout principles, the use of a hack saw, file, vise, tap and die to make thread and the use of a table-mounted drill press. The following activity will involve using all the information covered in the programmed text to construct an adjustable C-clamp.

GOALS

The student will learn to measure with a metal rule.

The student will learn the parts of and how to use a hack saw, file and vise.

The student will learn the parts of and the use of a tap and die to cut threads.

The student will learn the parts of and how to use a table-mounted drill press.

The student will learn and observe all safety rules needed to operate the equipment.

The student will make an adjustable C-clamp.

DIRECTIONS

To use the programmed self-instructional method of teaching, the student will begin with the Programmed Text.

The Programmed Text is a step-by-step process. In each section there will be an Instructional Objective which will explain briefly what the student is to do.

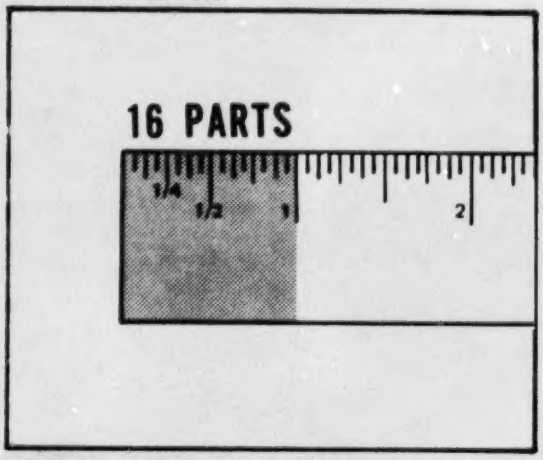
The sequence instruction is a step-by-step explanation of what is being done. It will be accompanied by a picture of each activity or a picture of the tool being explained in the Instructional Objective.

Each section of sequenced instruction will be followed by a Check Point. Follow the instructions given in each Check Point.

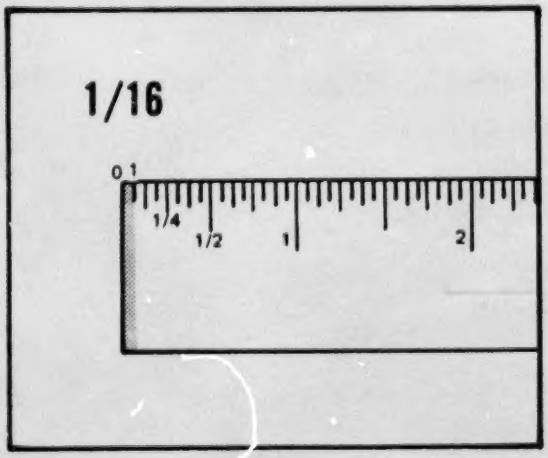
PROGRAMMED TEXT

Instructional Objective 1

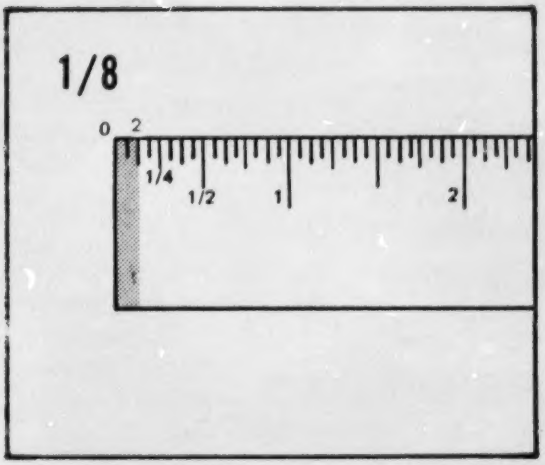
Being able to measure accurately is essential in doing metalwork. A person working with metal must be able to measure lengths, read dimensions, and figure materials. Obtain a metal rule.



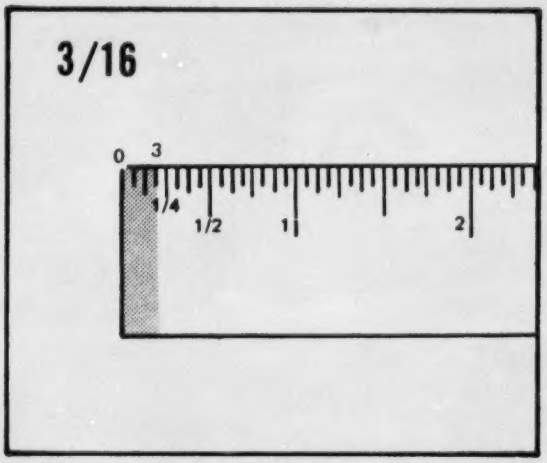
STEP 1 – To understand how to measure, you must understand the 16 parts of an inch. This shows an inch broken down into 16 equal parts.



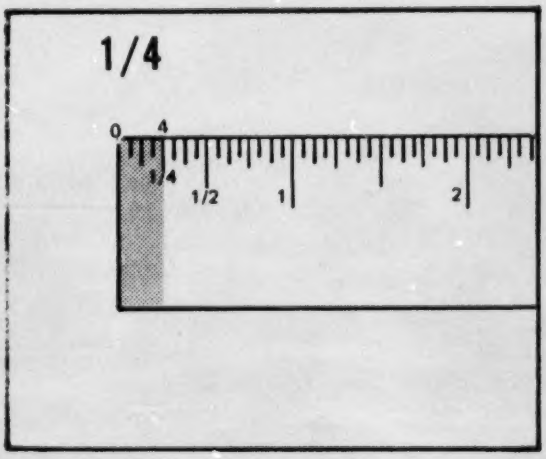
STEP 2 – From 0 to the mark labeled 1 is 1/16 inch.



STEP 3 – From 0 to the mark labeled 2 is 2/16 or 1/8 inch; we will call it 1/8 inch.

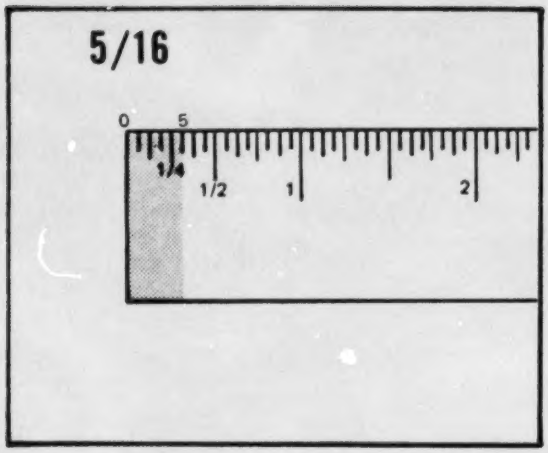


STEP 4 – From 0 to the mark labeled 3 is 3/16 inch.

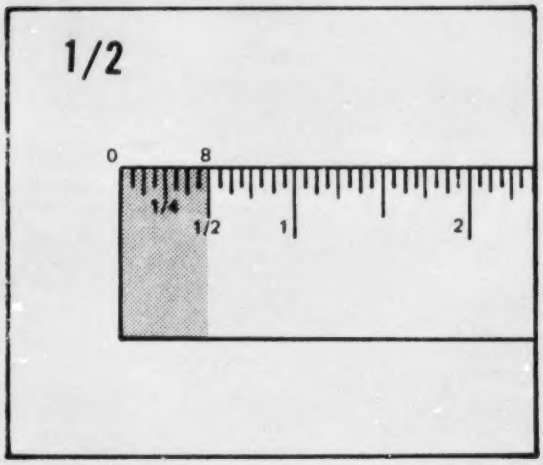


STEP 5 – From 0 to the mark labeled 4 is 4/16 inch or ¼ inch; we will call it ¼ inch.

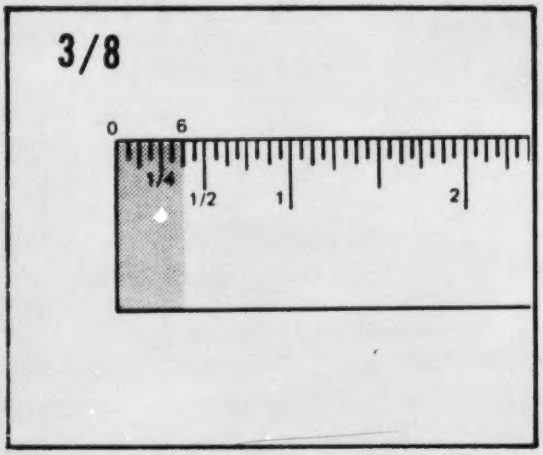
13



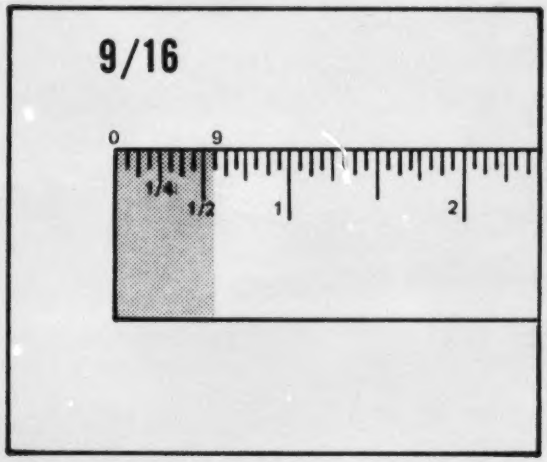
STEP 6 – From 0 to the mark labeled 5 is 5/16 inch.



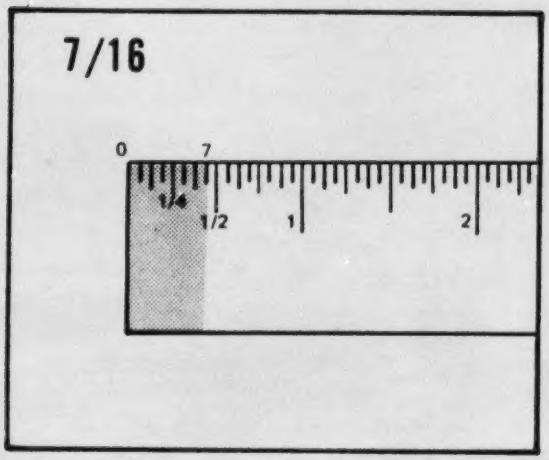
STEP 9 – From 0 to the mark labeled 8 is 8/16 inch, or ½ inch; we will call it ½ inch.



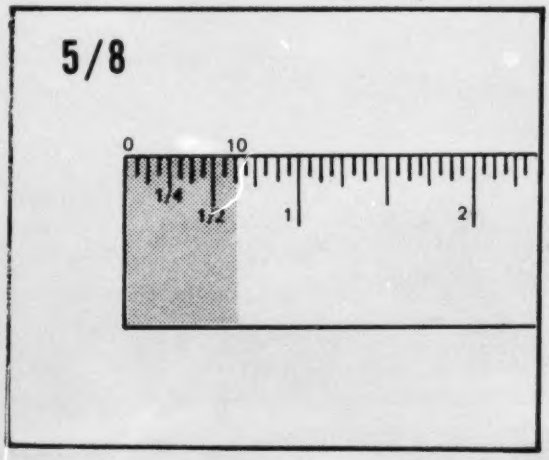
STEP 7 – From 0 to the mark labeled 6 is 6/16 or 3/8 inch; we will call it 3/8 inch.



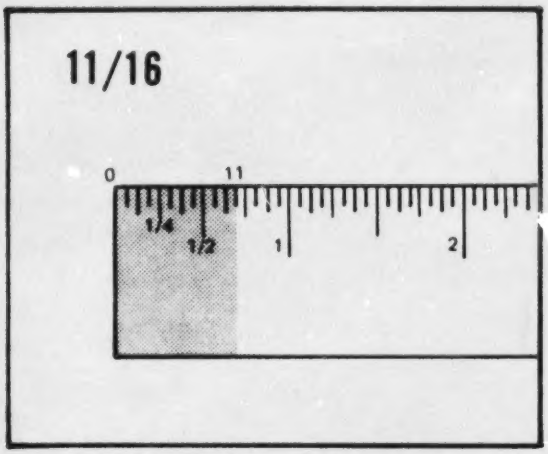
STEP 10 – From 0 to the mark labeled 9 is 9/16 inch.



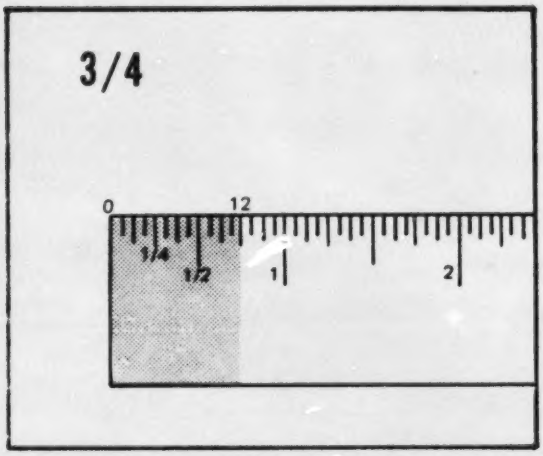
STEP 8 – From 0 to the mark labeled 7 is 7/16 inch.



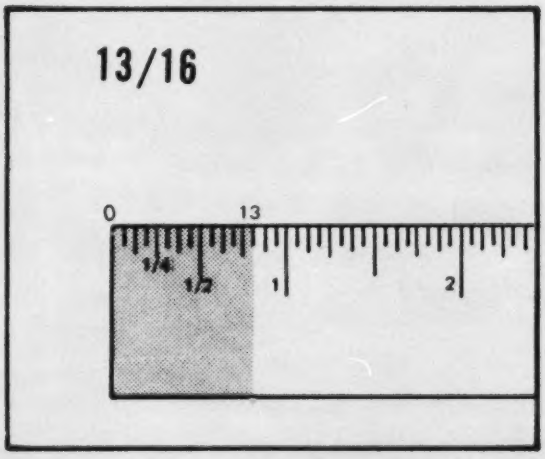
STEP 11 – From 0 to the mark labeled 10 is 10/16 inch or 5/8 inch; we will call it 5/8 inch.



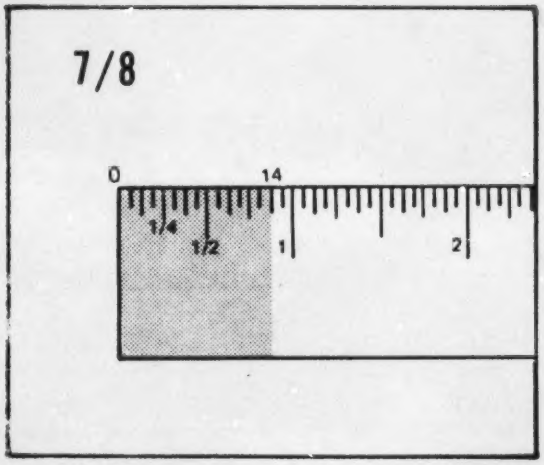
STEP 12 – From 0 to the mark labeled 11 is 11/16 inch.



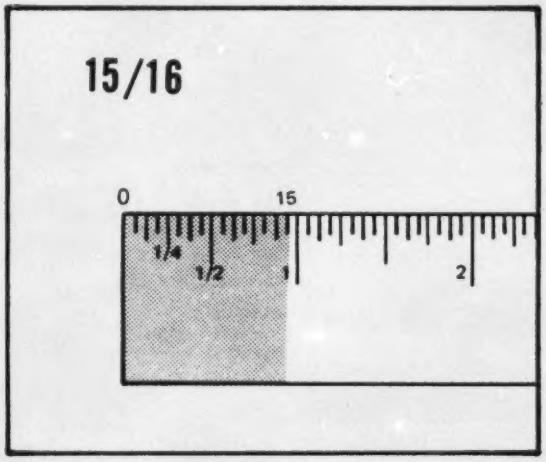
STEP 13 – From 0 to the mark labeled 12 is 12/16 or ¾ inch; we will call it ¾ inch.



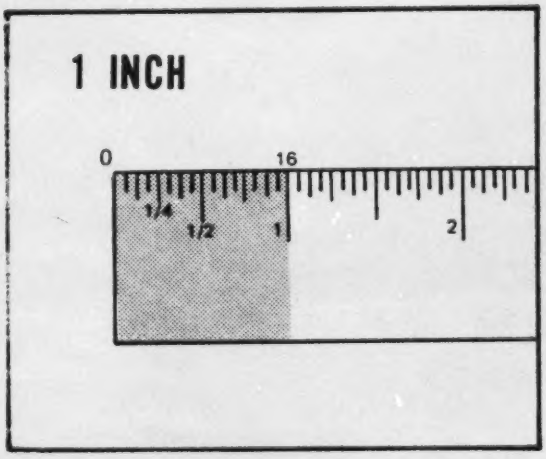
STEP 14 – From 0 to the mark labeled 13 is 13/16 inch.



STEP 15 – From 0 to the mark labeled 14 is 14/16 or 7/8 inch; we will call it 7/8 inch.



STEP 16 – From 0 to the mark labeled 15 is 15/16 inch.



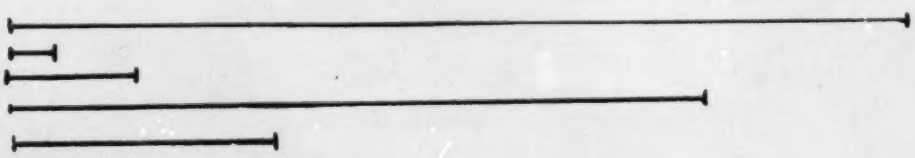
STEP 17 – From 0 to the mark labeled 16 is 16/16 or 1 inch.

STEP 18 – Look at the first inch on the metal rule.

Check Point

Using the metal rule and Student Check Sheet, measure lines 1 – 5. Place the letter of the correct measurement next to the number on your Student Check Sheet, Check Point No. 1.

A	¾"	1
B.	4"	2
C.	¼"	3
D.	1½"	4
E.	5 1/8"	5

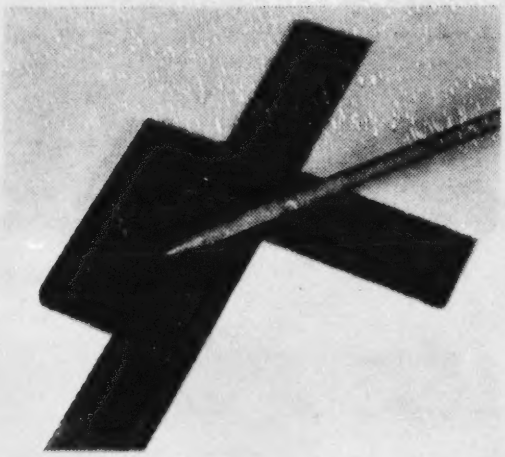


Instructional Objective 11

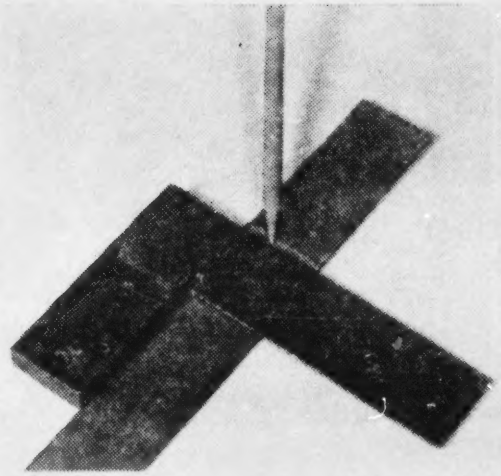
The student will be able to identify and use the five basic layout tools.

STEP 1 – The metal rule is 18 inches (45.72 cm) long and can be used as a straight edge for drawing lines.

STEP 2 – The second tool is the steel square. It is used to lay out and check right angles (90°).



STEP 3 – To use the square, place the handle against the edge of the metal.

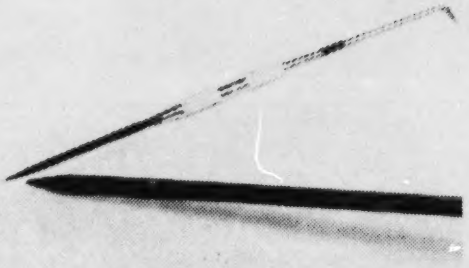


STEP 4 – The blade then lies across the metal. This lets you mark a line exactly 90° or a right angle.

STEP 5 – The third layout tool is the scribe and it has two main parts.

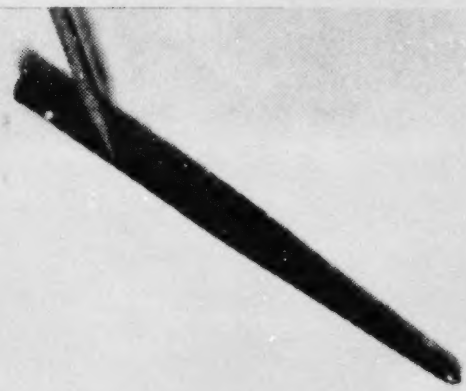
STEP 6 – The first part is the handle– this is what you hold the scribe with; the second is the blade which has a sharp point and is used to scratch a mark or line on the surface of metal.

17

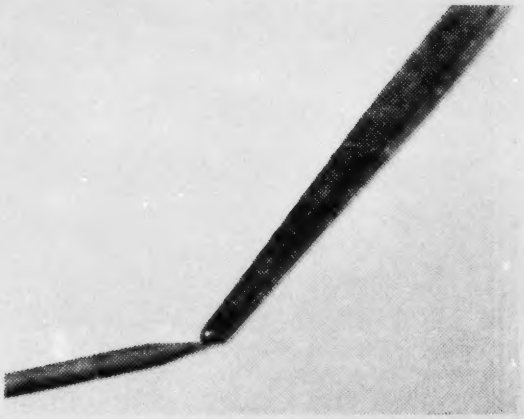


STEP 7 – SAFETY RULE: Since the scribe has a sharp point, caution must be observed. This point could punch a hole in your skin or cause eye damage.

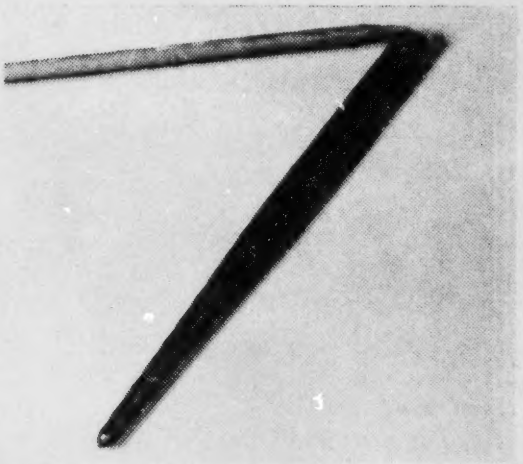
STEP 8 – The fourth layout tool is the center punch. The punch has three main parts; head, body, and point.



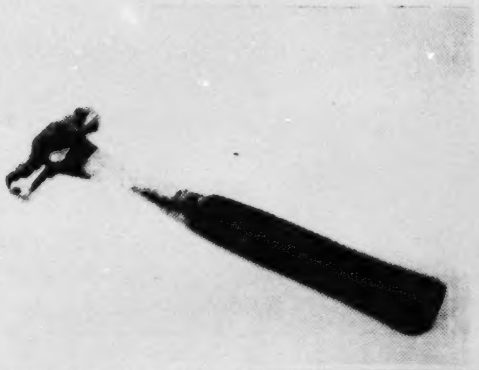
STEP 9 – The body is what the punch is held by.



STEP 10 – The point is sharp and it is placed on a mark.



STEP 11 – The head is where you tap it lightly with a hammer to cause the point to make an indention in the metal.



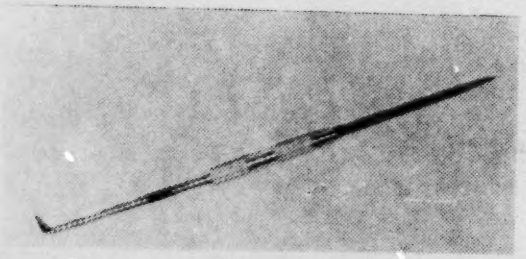
STEP 12 – The ball peen hammer is used to strike (hit) many of the metalworking tools, such as the center punch.

Check Point

Match the following tools with their names by placing the correct letter in the blank on your Student Check Sheet, Check Point No. II.

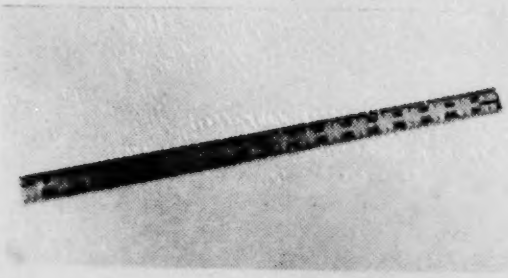
1. Ball peen hammer
2. Scribe
3. Center punch
4. Square
5. Metal rule

A.

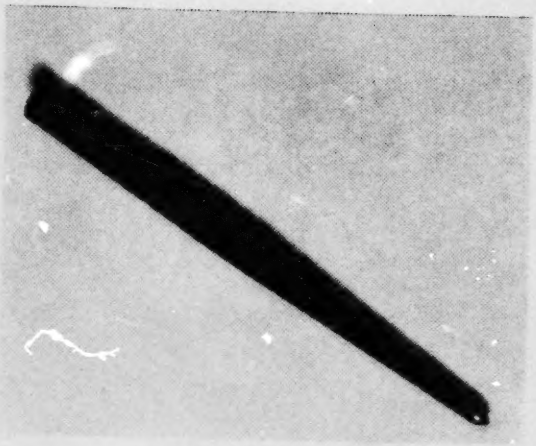


B.

C.



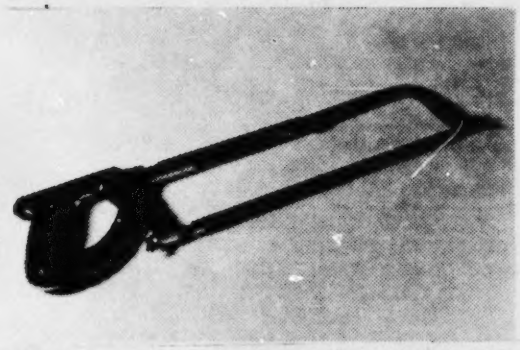
D.



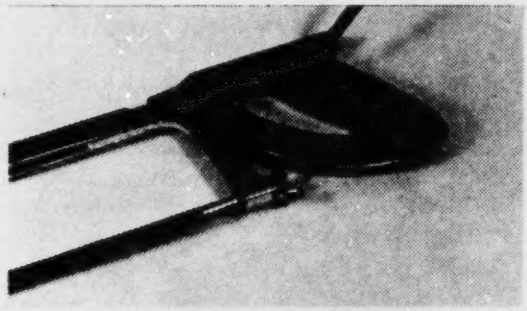
E.

Instructional Objective III

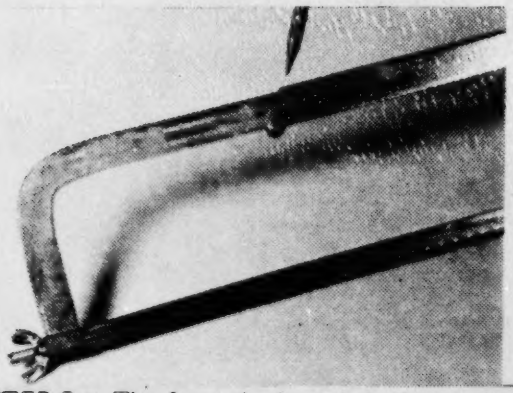
The student will become familiar with the parts of a hack saw and its proper use.



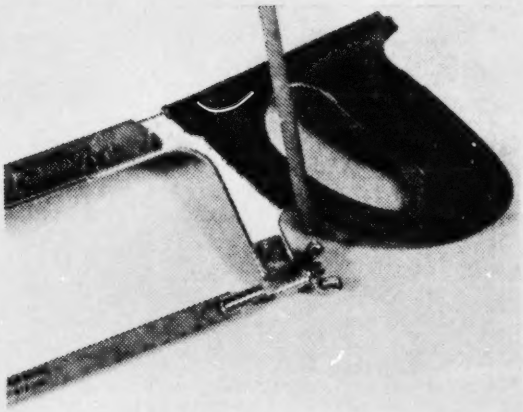
STEP 1 – The hacksaw has four major parts; handle, frame, tension adjustment, and blade.



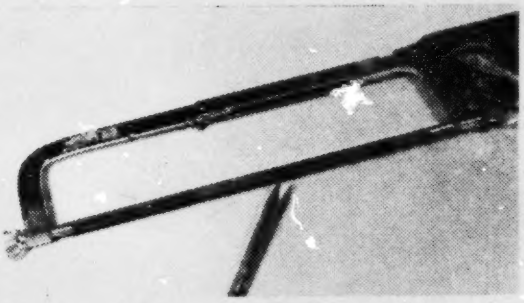
STEP 2 – The handle is shaped like a pistol grip to fit easily in the hand and make it more comfortable to use.



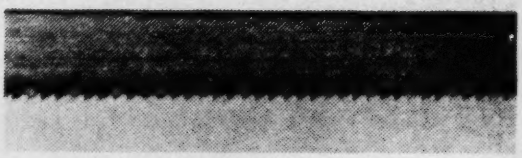
STEP 3 – The frame is shaped similar to the letter "U." It is adjustable and can be set to fit blades of various lengths.



STEP 4 – The tension adjusting unit consists of a wing nut and a sliding bolt. Its purpose is to apply tension on the blade.



STEP 5 – The blade is ½ inch wide (1.27 cm) and it is .025 inches thick. The length can be either 8 inches (20.32 cm), 10 inches (25.4 cm), or 12 inches (30.48 cm). The steel in a metal cutting saw blade must be harder than the metal to be cut so these blades are made of hardened steel. The size of teeth varies according to the number of teeth per inch.



STEP 6 – Pick the saw up and check to see that the blade is inserted correctly.

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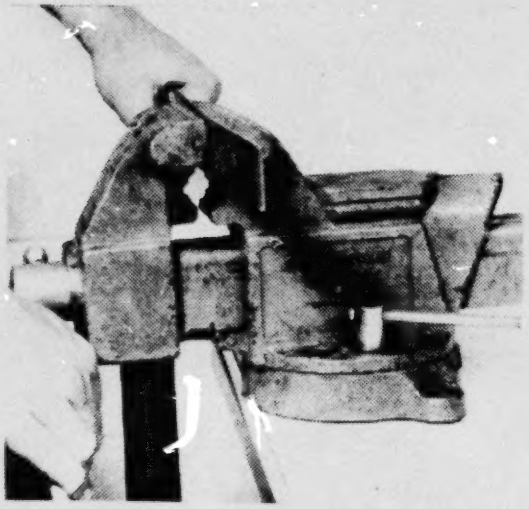
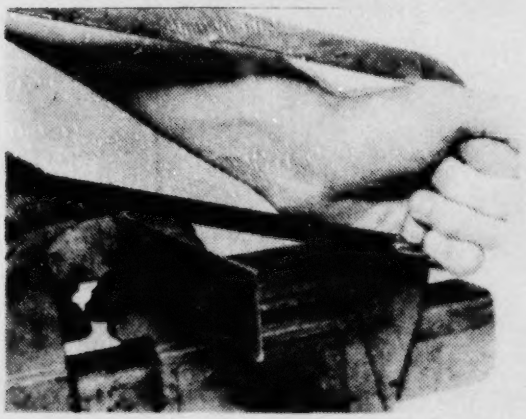
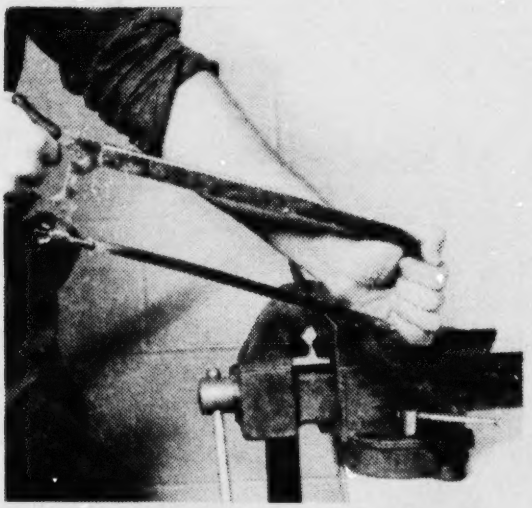
STEP 7 – Check the blade tension and adjust it, if needed, by turning the wing nut on the blade tension adjustment.



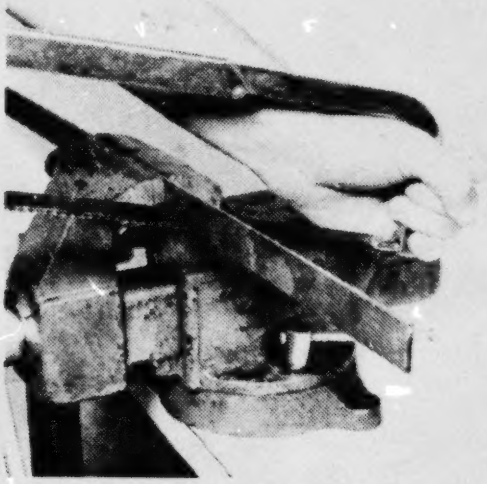
STEP 8 – The metal to be cut should be put in a vise.



STEP 9 – To start a cut, the blade should be placed on the metal with as many teeth as possible touching the metal.



STEP 10 – Stand in a relaxed position at the vise and hold the saw correctly.



STEP 11 – Put the saw blade down against the metal. Push the saw forward and apply just enough pressure to cause the blade to cut the metal.

STEP 12 – Continue sawing with a light pressure until the cut is started. Do not use a rapid, jerky sawing motion; use a smooth back and forth motion, with a full stroke of the blade.

STEP 13 – Use less pressure on the saw when the cut is almost through the metal.

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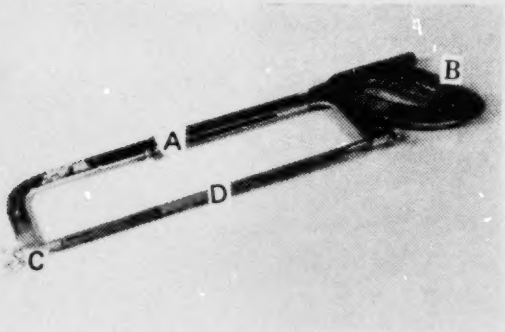
Check Point

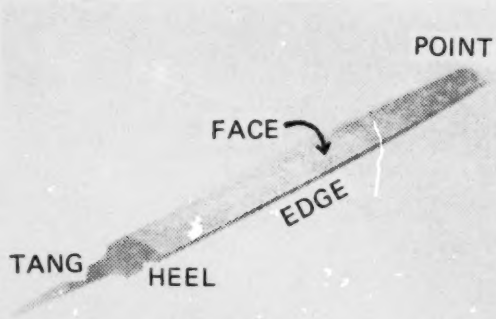
Match the parts of the hack saw with their names by placing the correct letter in the blank on your Student Check Sheet, Check Point No. III.

1. Tension adjustment
2. Blade
3. Frame
4. Handle

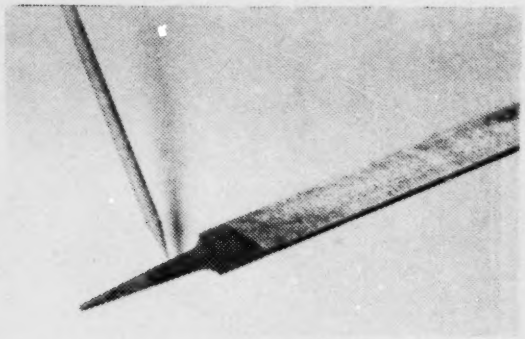


Instructional Objective IV

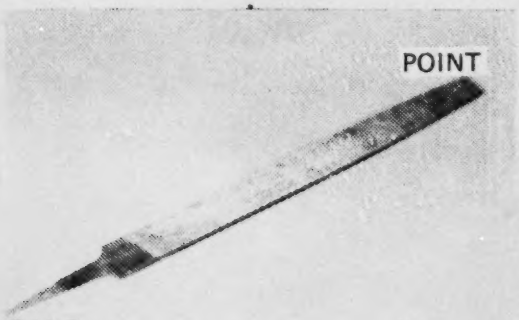
The student will identify the parts of a file and its proper use.



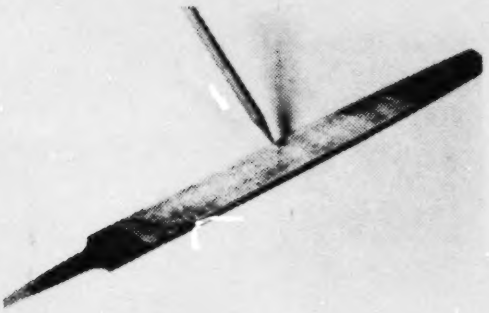
STEP 1 – There are five parts of a file: the point, face, edge, heel, and tang.



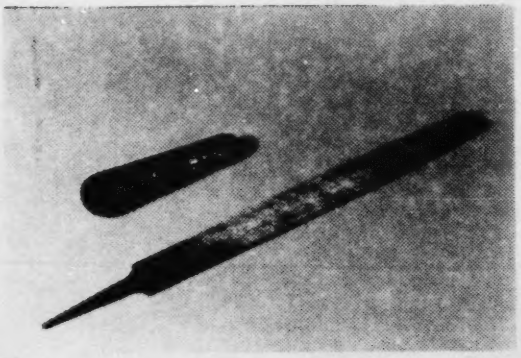
STEP 2 – The tang is the narrow end of a file where the handle is fastened.



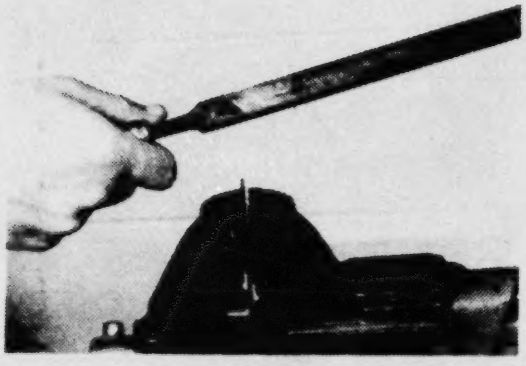
STEP 3 – The size of a file is the length measured from the end of the point to the end of the tang.



STEP 4 – The teeth of the file are made of hardened steel because they must be harder than the metal being filed. The teeth do the cutting.

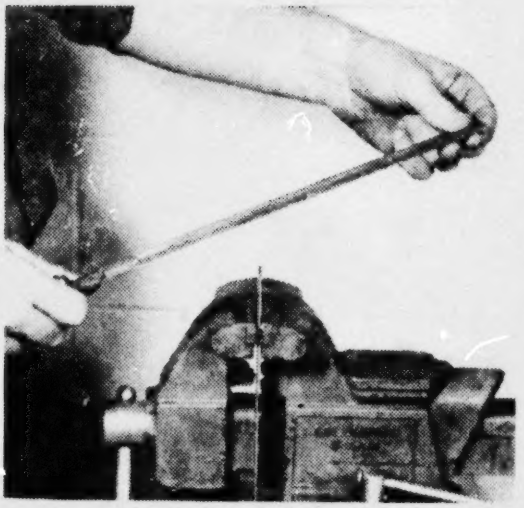


STEP 5 – A wooden handle fits on the tang and is tightened by tapping it on a table or floor.

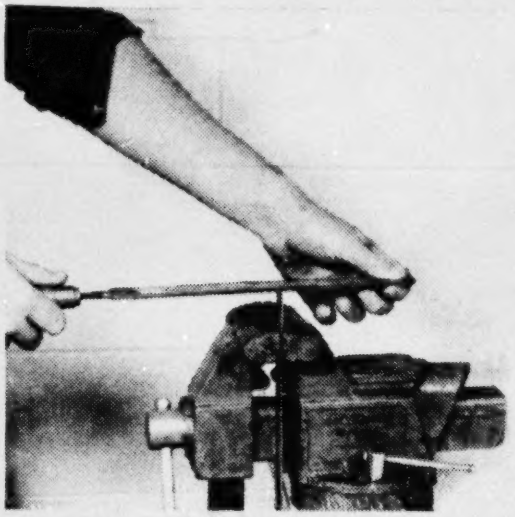


STEP 6 – Hold the handle in either the right or left hand according to your preference.

SAFETY NOTE: To avoid injury always use the file with the handle tightly secured to the tang.



STEP 7 – Grab the point with the thumb and first two fingers of the other hand.



STEP 8 – Stand in a relaxed position.

STEP 9 – Place the file flat on the metal with the teeth pointing to the front.

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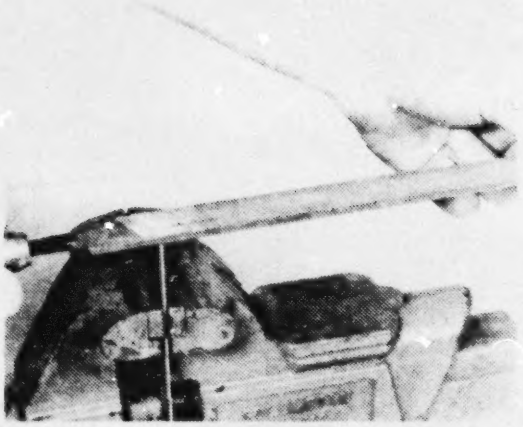
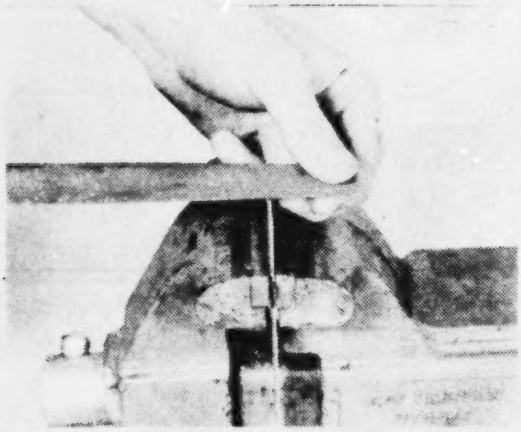
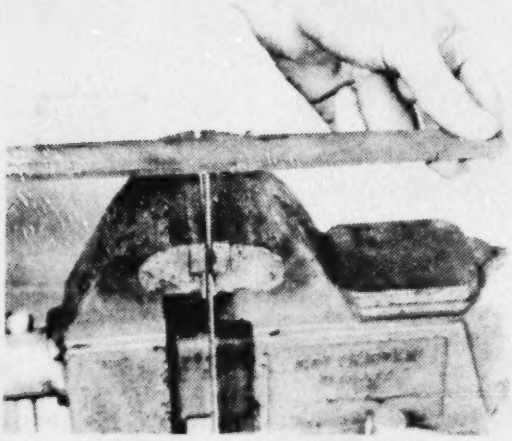


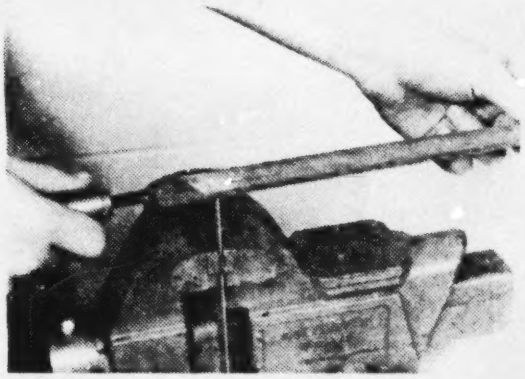
STEP 10 – Keep the file level and push it across the metal.



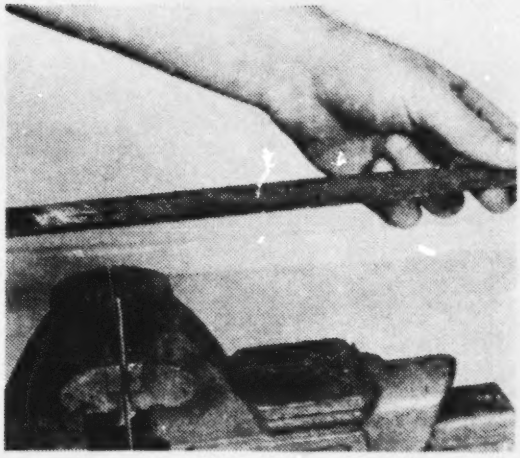
STEP 11 – Apply more pressure with the hand in front at the start of the stroke.



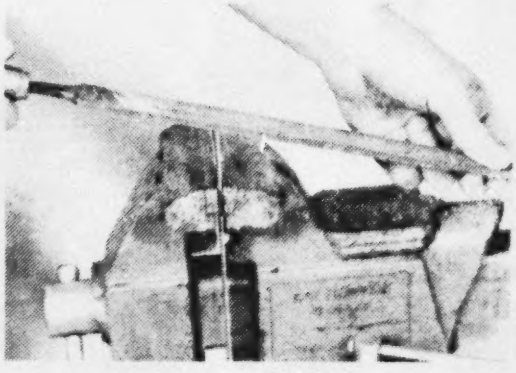
STEP 12 – Release some of the pressure of the front hand when the file reaches the center.



STEP 13 – Apply more pressure with the back hand for the rest of the stroke.

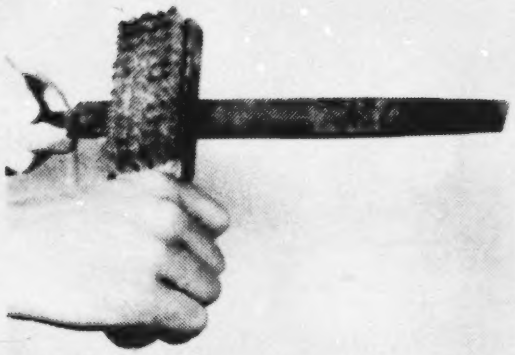


STEP 14 – The file cuts only in one direction on the forward stroke. It should be lifted on the return stroke.



STEP 15 – Keep the file from rocking on the metal; this is the most common error.

SAFETY NOTE: To avoid injury always use the file with the handle tightly secured to the tang.

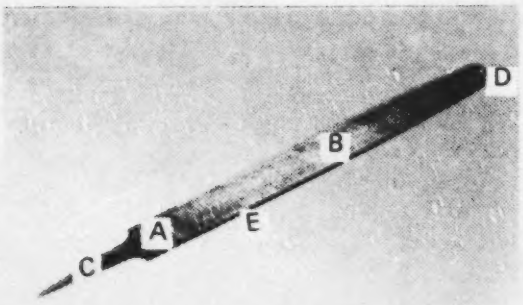


STEP 16 – Cleaning a file is done with a file card.

Check Point

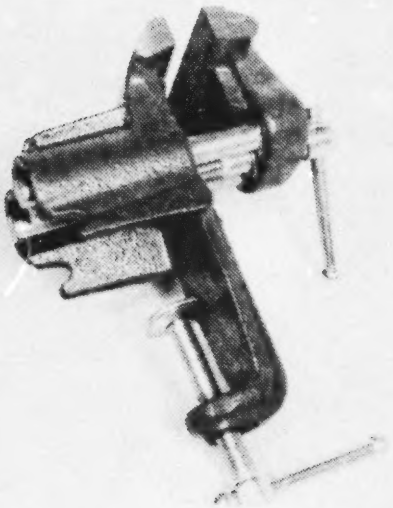
Match the parts of a file with their name by placing the correct letter in the blank on your Student Check Sheet, Check Point No. IV.

1. Tang
2. Face
3. Point
4. Edge
5. Heel

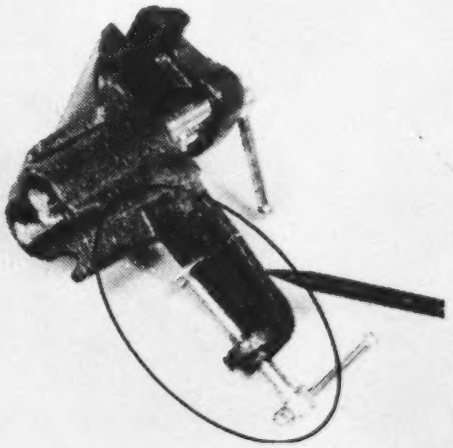


Instructional Objective V

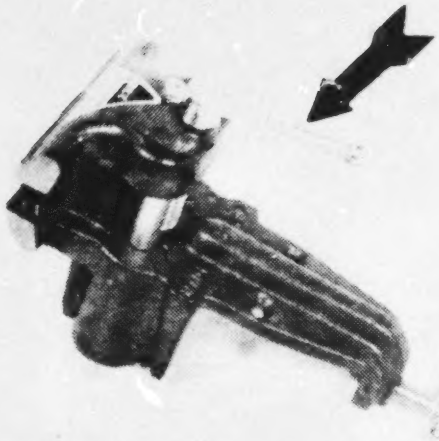
The student will identify the parts of a vise and its proper use.



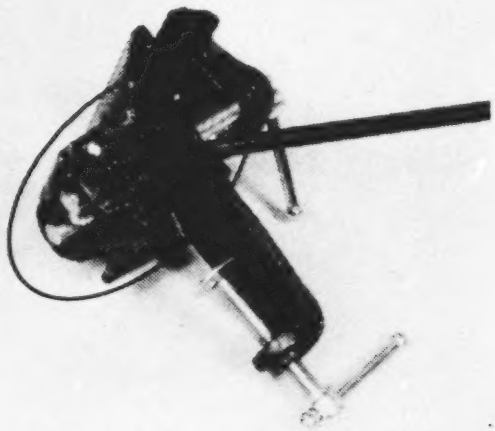
STEP 1 – There are four basic parts to a vise, the handle, table clamp, jaws, and body.



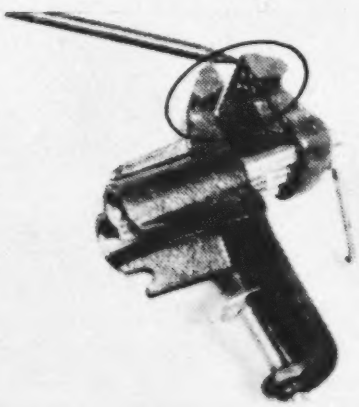
STEP 2 – The table clamp is adjustable so that it will fit different tables. The adjustment has a bolt going through it which, when run in, tightens on the table.



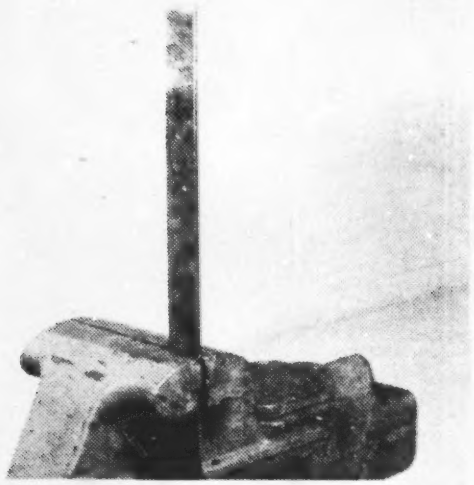
STEP 3 – The handle is on the end of a big bolt which tightens or loosens the vise.



STEP 4 – The body is the largest part of the vise; it gives the vise strength.

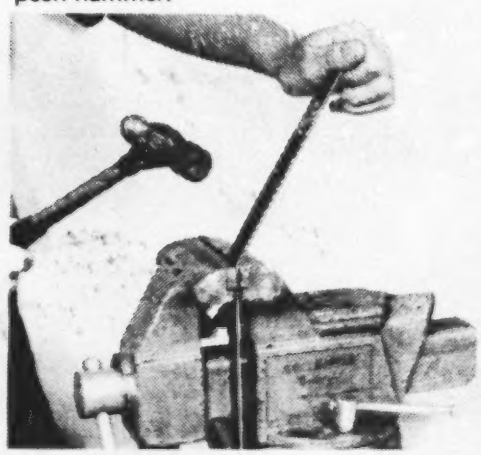


STEP 5 – The jaws are what clamp the metals in place.

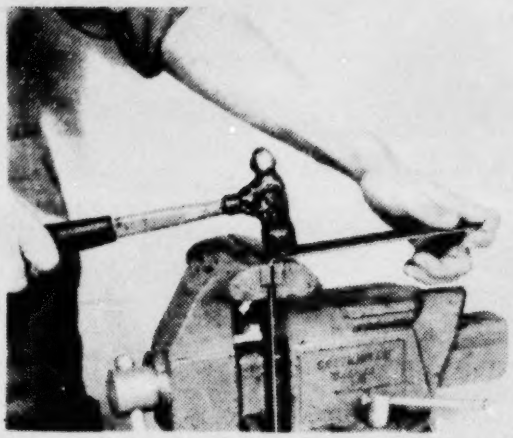


STEP 6 – Using a vise to bend metal, place the metal in the vise and tighten the jaws against the metal.

STEP 7 – Pick up the 8 oz. (226.8 g) ball peen hammer.

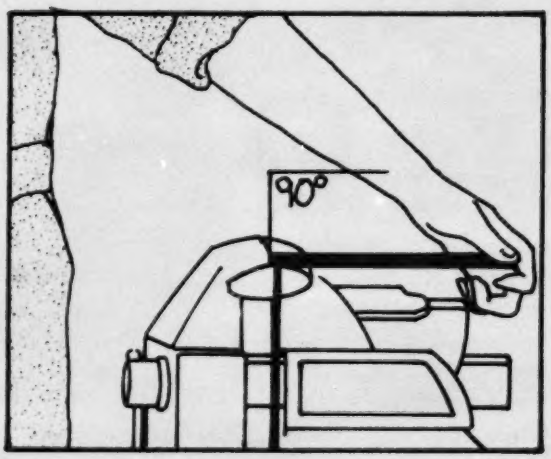


STEP 8 – Start the bend by lightly hitting the metal close to the jaws.



STEP 9 – Continue tapping the metal until it is bent down to 90° or a right angle.

STEP 10 – Take the metal out of the vise and check it with a square.



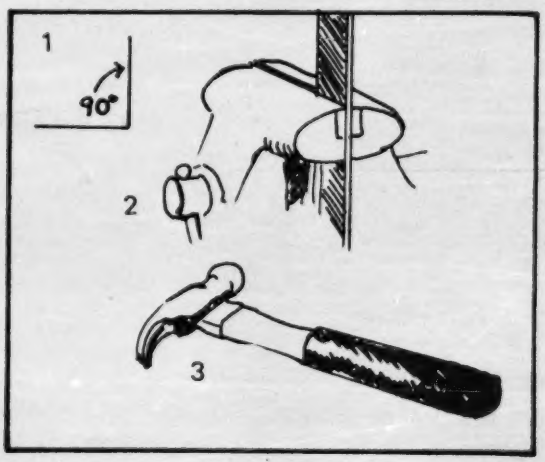
STEP 11 – If the metal is not 90°, put it back in the vise with the bend parallel to the jaws.

STEP 12 – Tap it with the hammer and then check it with the square.

Check Point

Answer the following questions with either a YES or a NO in the blanks on your Student Check Sheet, Check Point No. V.

(1) This is a right angle
(2) This is the correct way to put metal in a vise before bending it.
(3) This is the correct hammer to use when bending metal.



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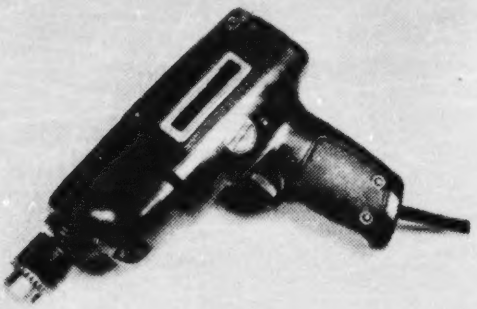
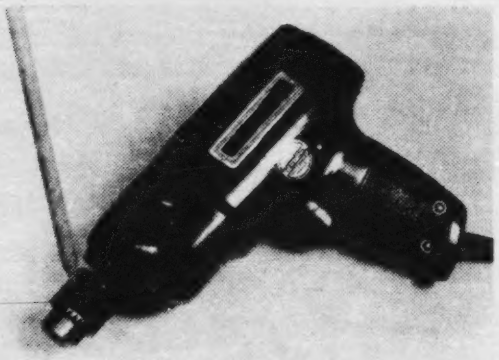
Instructional Objective VI

The student will identify the parts of a ¼" (.635 cm) hand power drill, how to use the drill correctly, and the safety rules which are observed when using a drill.

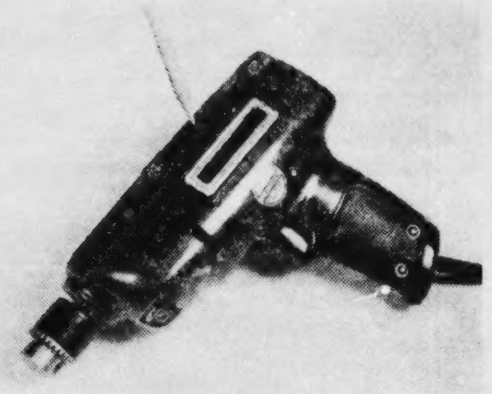


STEP 1 – The parts of a ¼" (.635 cm) hand drill are the chuck, trigger switch, handle, power cord, and chuck key.

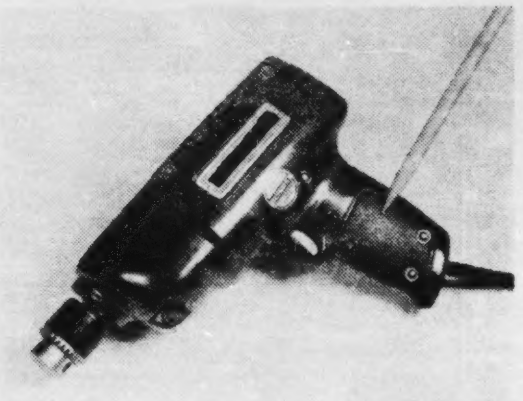


STEP 2 – The chuck holds the drill bit and it is tightened with the chuck key.

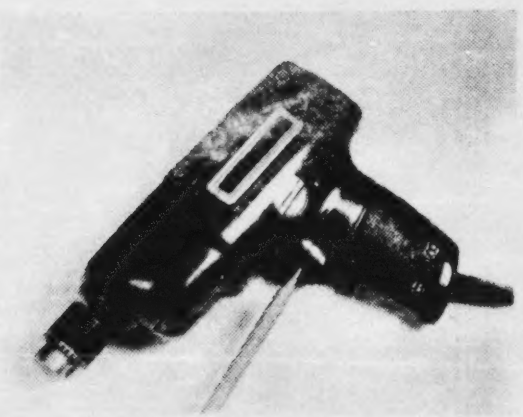
STEP 3 – The chuck key fits in the chuck.



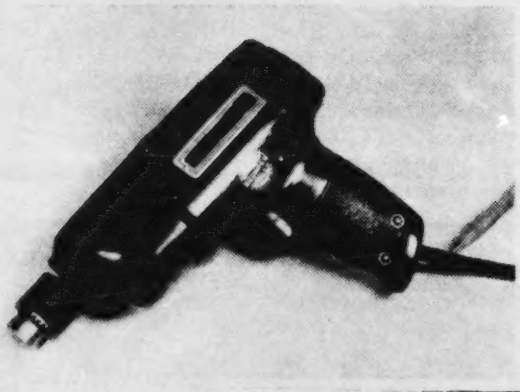
STEP 4 – The frame of the drill protects the electric motor which drives the drill.



STEP 5 – The handle is used to hold the drill.

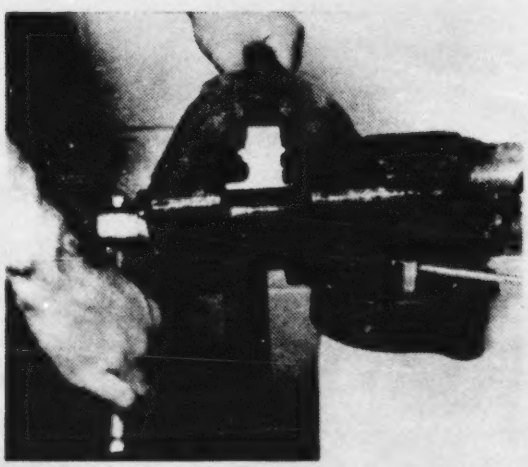


STEP 6 – The trigger switch is mounted in the handle; it is spring loaded to turn the drill off when you release the trigger.

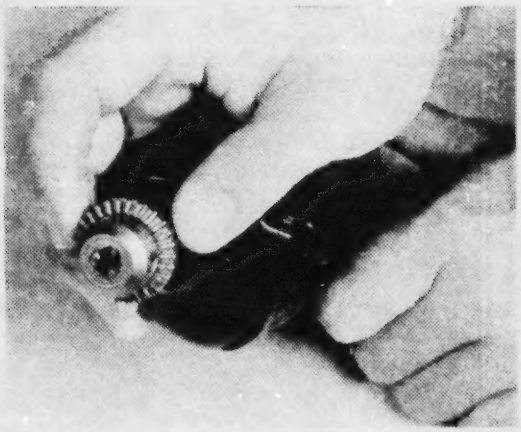


STEP 7 – The power cord is used to plug the drill into a wall outlet.

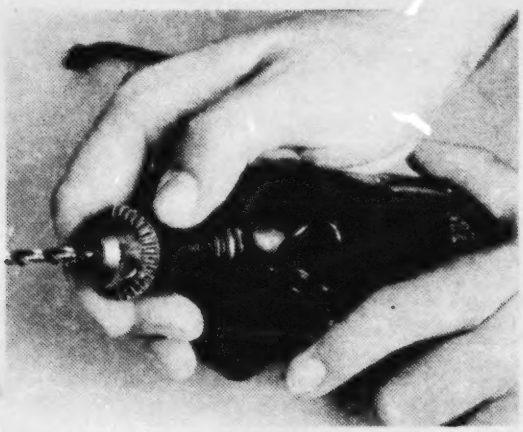
STEP 8 – REMEMBER THIS SAFETY RULE: Always wear safety glasses when using a drill.



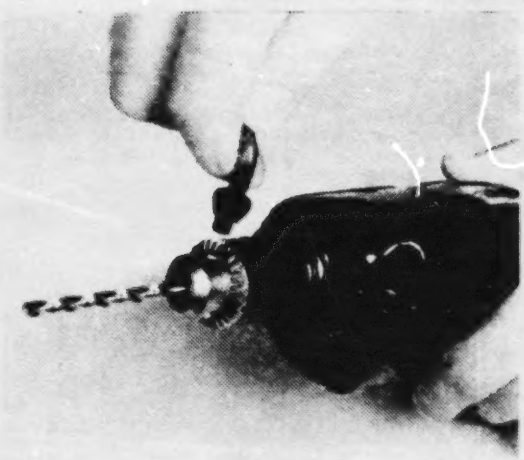
STEP 9 – REMEMBER THIS SAFETY RULE: Always put the metal to be drilled in a vise.



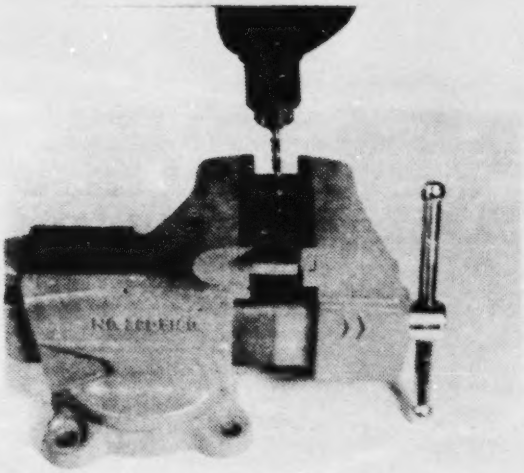
STEP 10 – To put a drill bit in a drill, the chuck may need to be loosened.



STEP 11 – Put the bit in the drill with sharp point out, then tighten chuck against the bit.

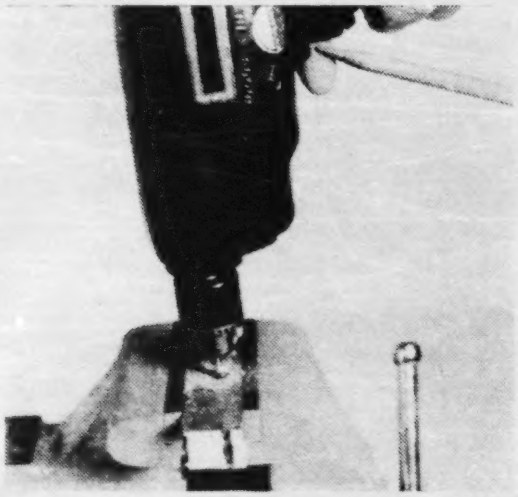


STEP 12 – Remember to remove chuck key before starting drill.

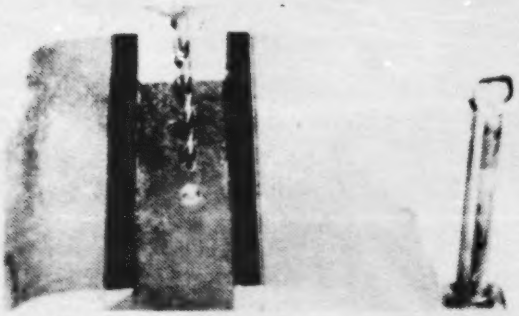


STEP 13 – Put the drill bit point against the metal to be drilled and hold the drill straight.

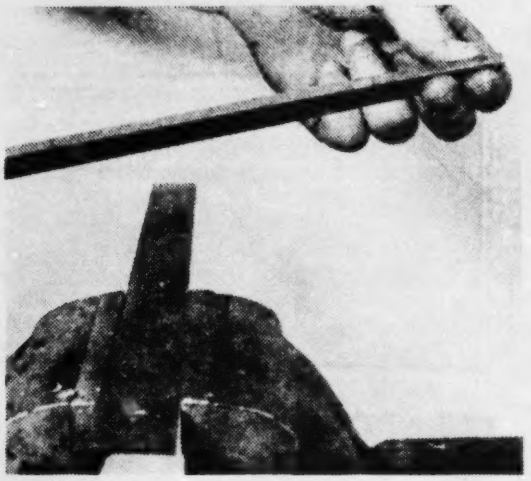
STEP 14 – The drill should be 90° to the metal.



STEP 15 – Drill the hole; when the bit goes through the metal, release the trigger to stop the drill.



STEP 16 – Pull the drill upward taking the bit out of the hole.



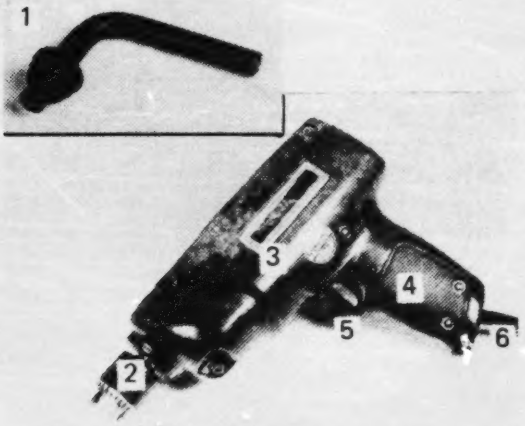
STEP 17 – There will be burrs on the bottom of the metal where the hole was drilled.

STEP 18 – Use a file to remove the burrs.

Check Point

Match the following parts of a power hand drill with their correct number on your Student Check Sheet, Check Point No. VI.

A.	Handle	D.	Chuck Key
B.	Trigger Switch	E.	Chuck
C.	Electric Cord	F.	Frame



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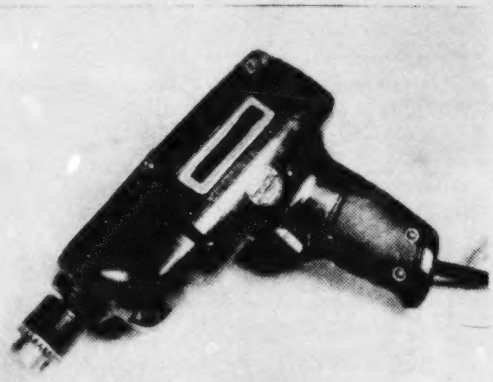
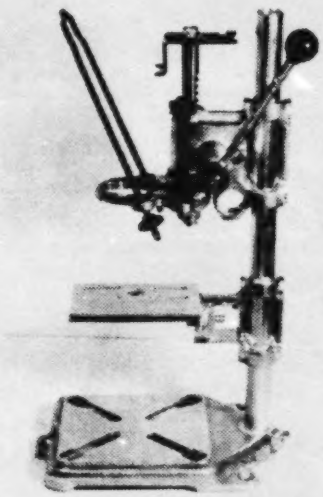
Instructional Objective VII

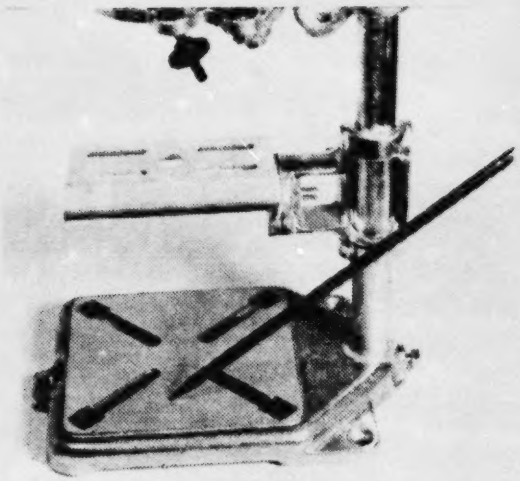
The student will identify the parts of a table-mounted drill press and learn its proper use.



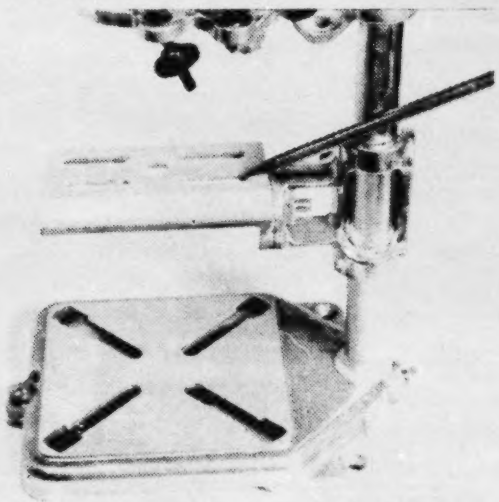
STEP 1 – The drill stand is made to hold either a 1/4 inch or 3/8 inch hand drill.



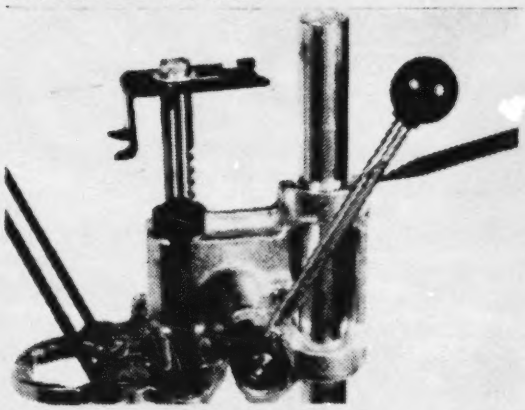
STEP 2 – There are five basic parts of the drill stand – the stand, bed, feed arm, depth gauge, and drill clamp.



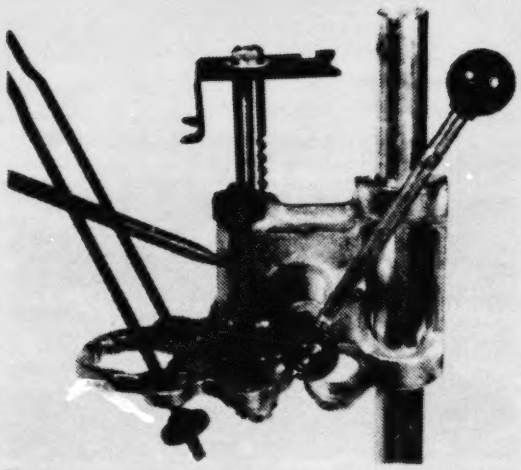
STEP 3 – The stand balances the rest of the equipment while it sits on the table.



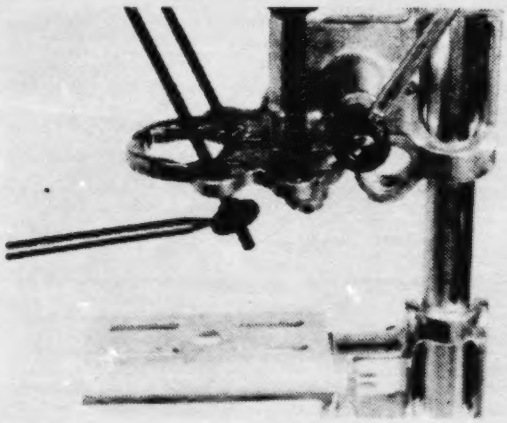
STEP 4 – The bed is where the vise is bolted and the height can be adjusted by a nut on the side near the shaft.



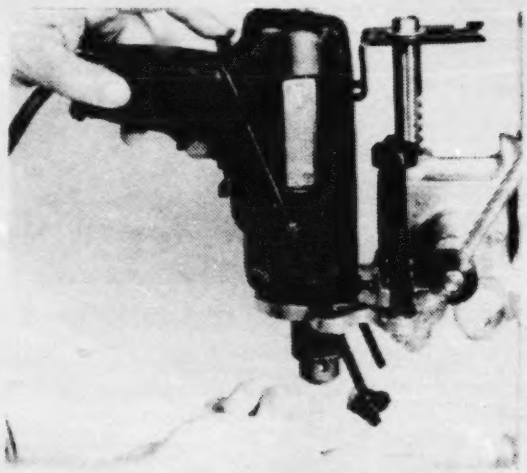
STEP 5 – The feed arm controls the up and down movement of the drill.



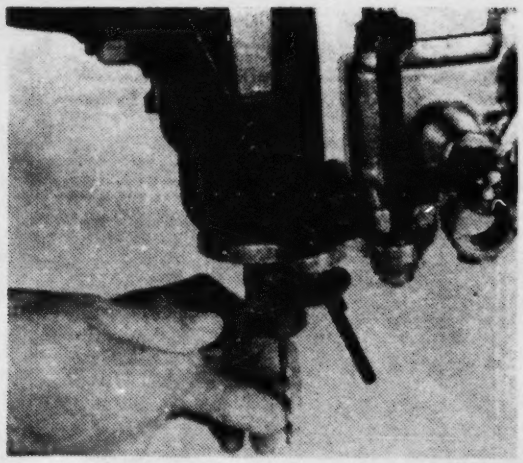
STEP 6 – The depth gauge sets the depth the drill will go down.



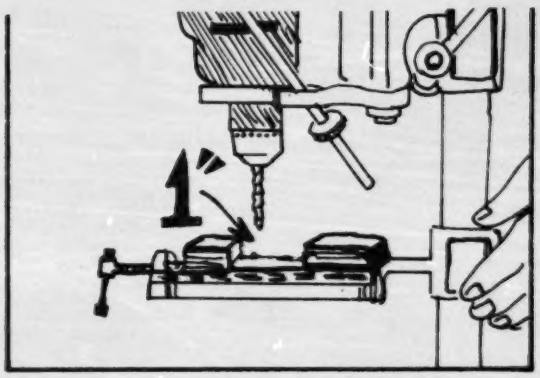
STEP 7 – The clamp for the drill is tightened by thumb screws on the bottom of the clamp.



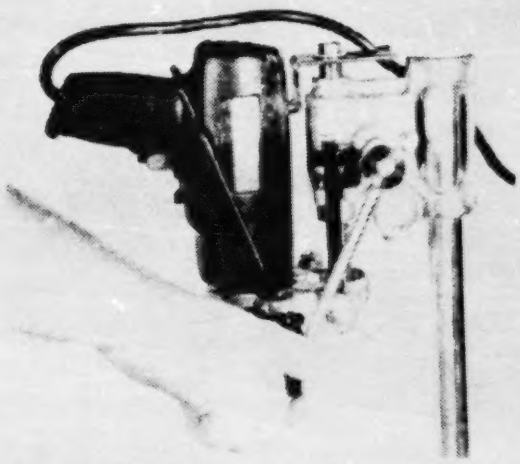
STEP 8 – Put the 3/8 inch drill in the drill stand. Tighten the screws.



STEP 9 – Put a bit in the drill chuck.

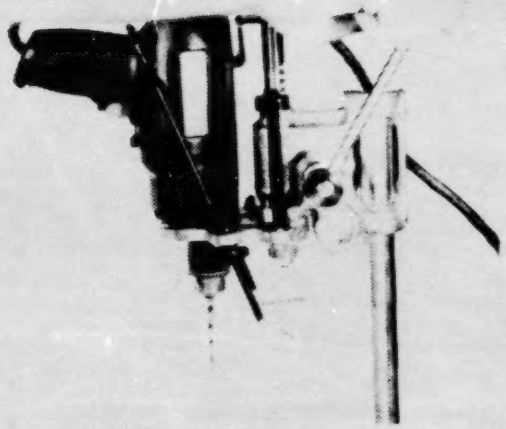


STEP 10 – Adjust bed height so that vise is about 1" (2.54 cm) below the point of the drill bit.

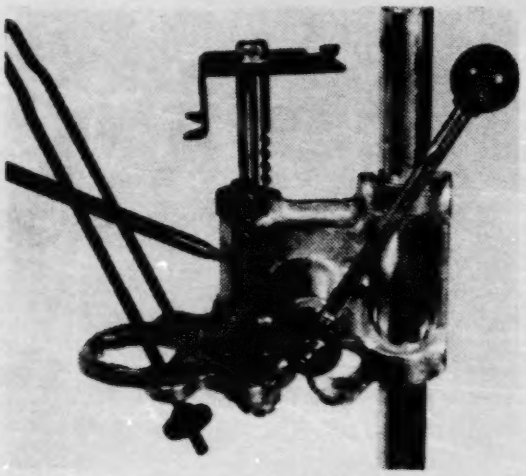


STEP 11 – Grab feed handle and pull it down gently.

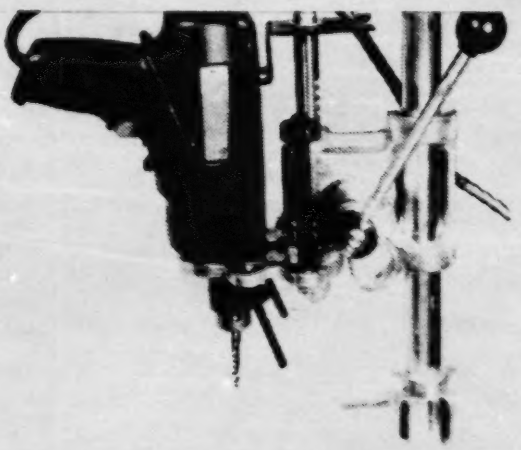
32



STEP 12 – Let the feed handle back up easily.



STEP 13 – If the depth gauge will not let the bit go down far enough to drill through a piece of metal 1" (2.54 cm) thick, adjust it lower.

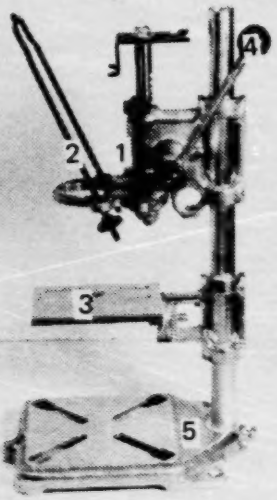


STEP 14 – [illegible]

Check Point

Match the parts of the drill stand with their correct names by placing the number in the blank on your Student Check Sheet, Check Point No. VII.

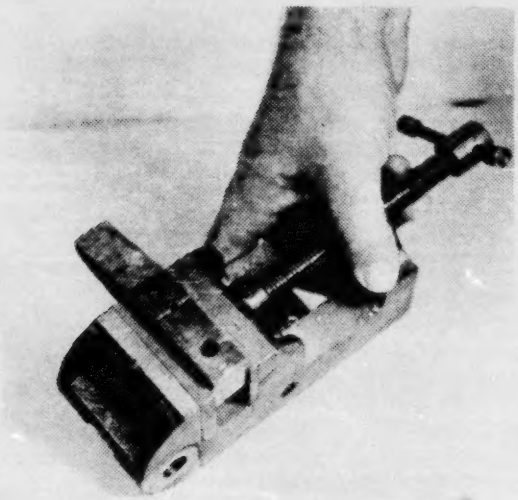
A. Bed
B. Drill clamp
C. Depth gauge
D. Feed arm
E. Stand



33

Instructional Objective VIII

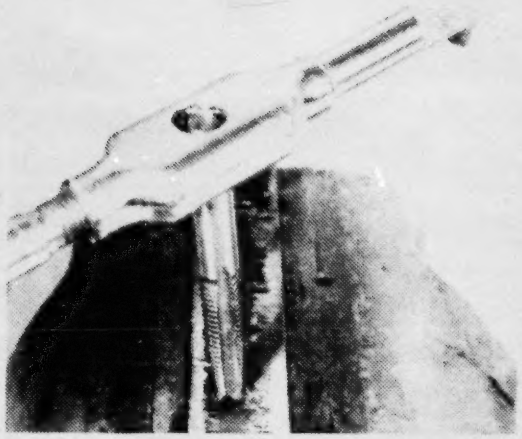
The student will identify the parts of a tap and learn its proper use.



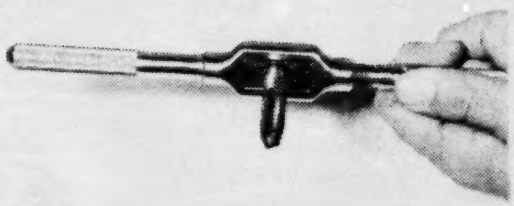
STEP 1 – Before a hole can be tapped out, it must be drilled to the correct size.

STEP 2 – The size of a tap and the hole size is always stamped on the tap.

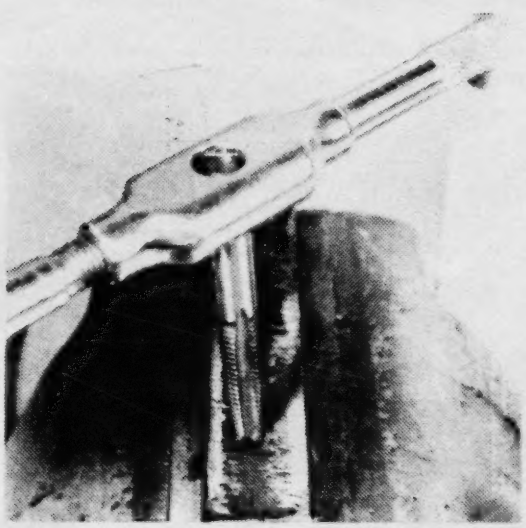
STEP 3 – For example, 3/8"- 16 NC - 5/16". This means the threads will be 3/8" with 16 threads per inch and the hole size is to be drilled 5/16 of an inch (.79375 cm).



STEP 4 – When the hole is drilled, it is smaller than the tap so the threads can be cut.

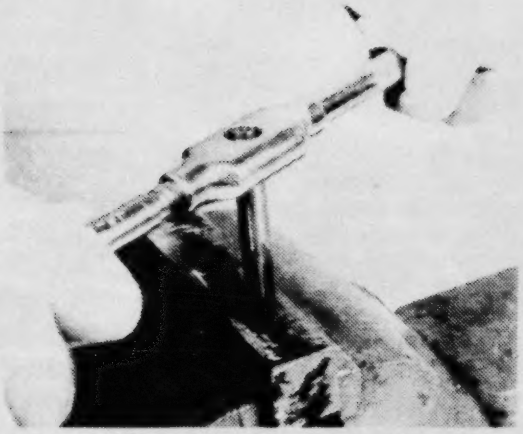


STEP 5 – Put the square end of the tap in the tap handle and tighten it.

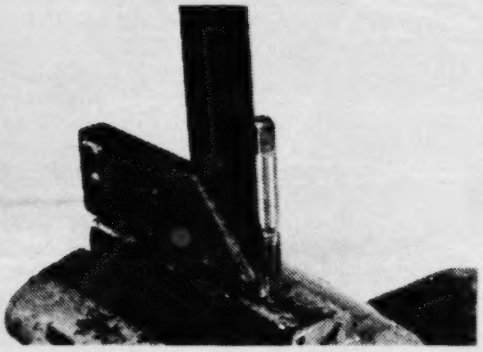


STEP 6 – Put the point of the tap in the hole keeping it straight.

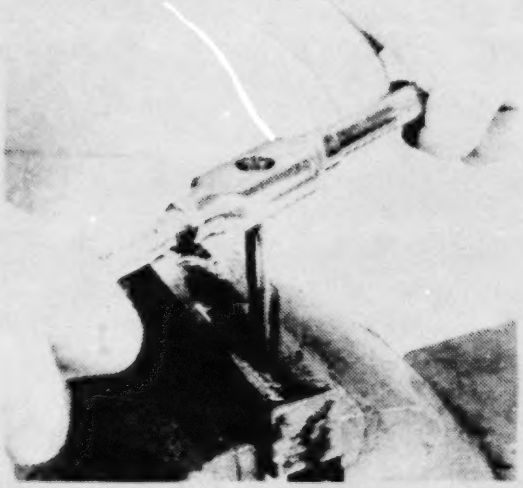
34



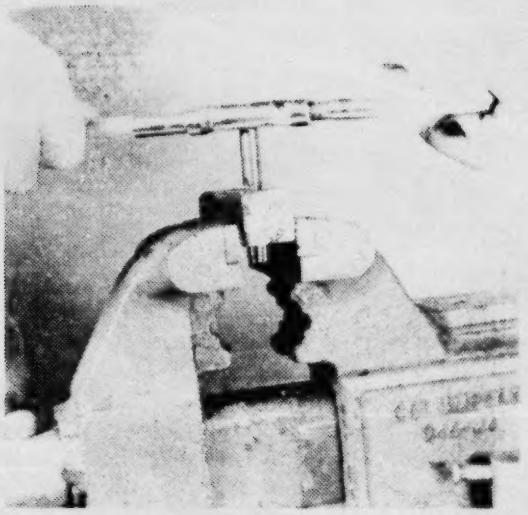
STEP 7 – Turn the tap in a clockwise direction.



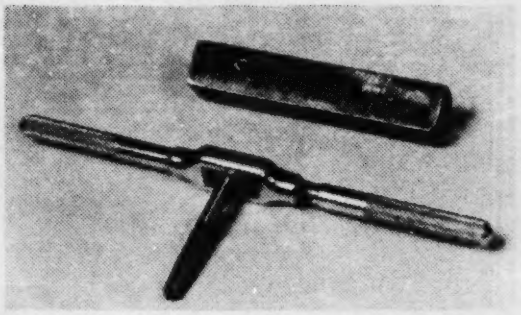
STEP 8 – When the tap is started, check it with a square to see if it is straight.



STEP 9 – If so, continue turning the tap. For each full turn, back the tap up ¼ of a turn to break off the chips of metal in the tap.



STEP 10 – Continue this procedure until the hole is threaded all the way through.



STEP 11 – Remove the tap and lay it down.

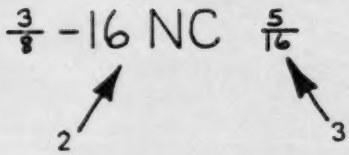
35

Check Point

Match the parts of the tap with their correct names by placing the number in the blank on your Student Check Sheet, Check Point No. VIII.

A Tap
B Size hole to drill
C Size threads per inch
D Tap handle

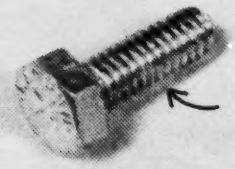
1



4

Instructional Objective IX

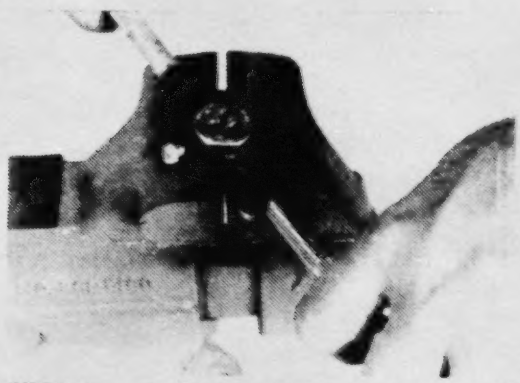
The student will identify the parts of a die and learn its proper use.



STEP 1 – The die cuts outside threads.

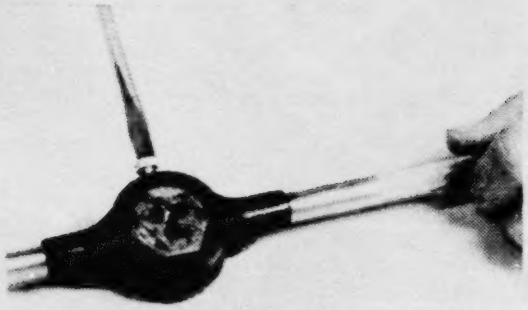
STEP 2 – The die is circular in shape with a hole in the center.

STEP 3 – The teeth that cut the metal are located in this hole.



STEP 4 – A die is made to thread a certain size shaft.

36

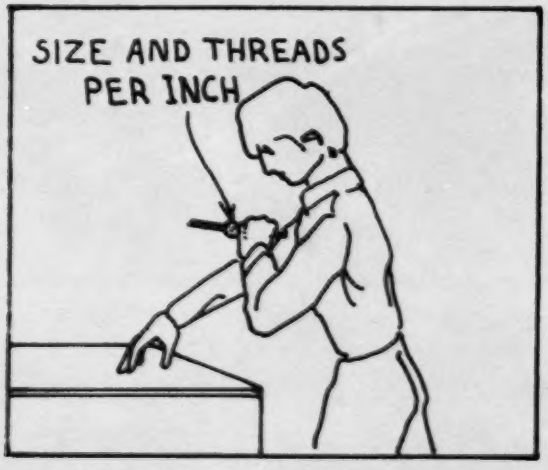


STEP 5 – If too large, it will not start.

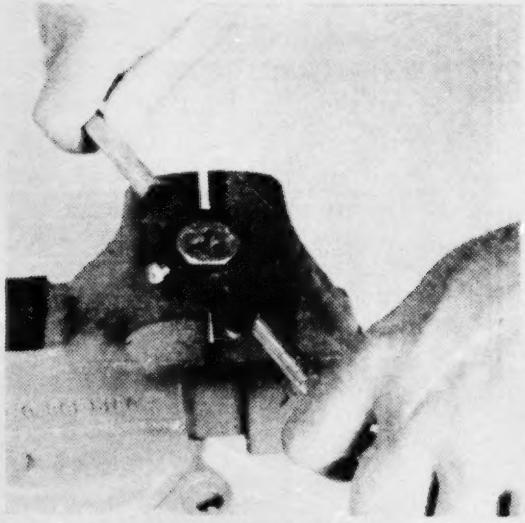
STEP 6 – If too small, the threads will give a loose fit.

STEP 7 – The die fits in the handle and is locked in with 3 set screws or one lock bolt.

STEP 8 – Look at the die. One side says start this side.



STEP 9 – The other side gives size and threads per inch.



STEP 10 – Start the die by turning in a clockwise direction.

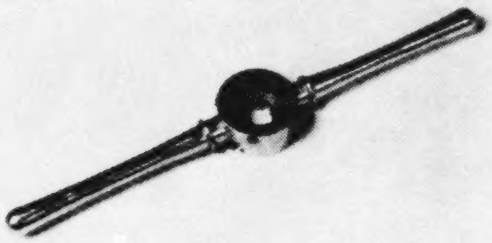
STEP 11 – For every full turn of the die, back up ¼ turn to break off chips.

STEP 12 – When threads are as far as needed, reverse the direction of the die and back it off and lay it down.

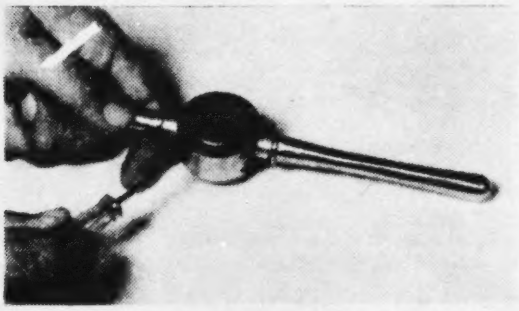
Check Point

Match the parts of the die with their correct names by placing the number in the blank on your Student Check Sheet, Check Point No. IV.

A. Die
B. Die handle
C. Lock screw
D. Size die



1.



2.

3.

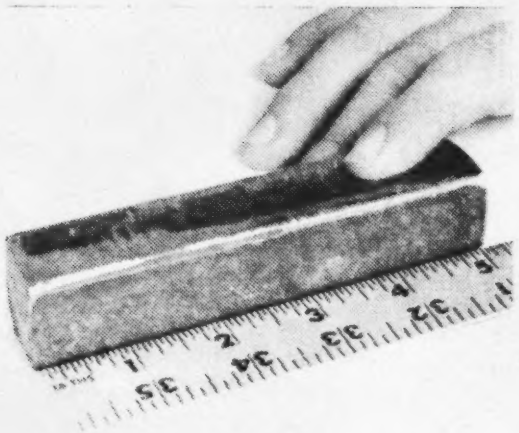
4.

INTRODUCTION

This section will be concerned with measuring, cutting, drilling, tapping threads, using a die to cut threads, and putting together an adjustable C-clamp. In the sequential instruction, follow each step in order.

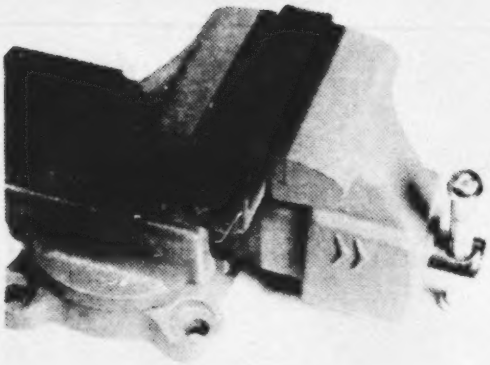
Instructional Objective X

The student will measure and cut stock.

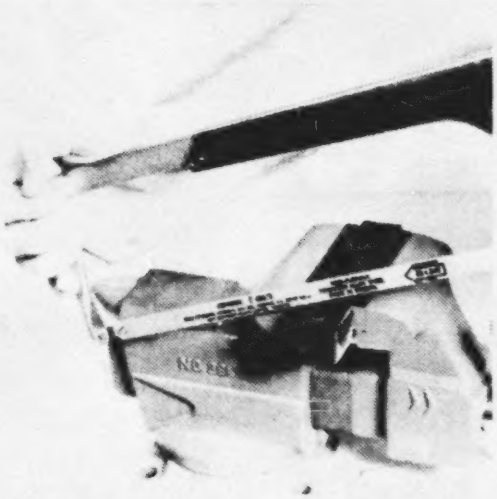


STEP 1 – Using the rule, measure a piece of ¾" x 1" (1.905 cm x 2.54 cm) rectangular metal 4" (10.16 cm) long and mark it.

STEP 2 – Using the square, line it up on the mark at 4" (10.16 cm) and scribe a mark across the metal.



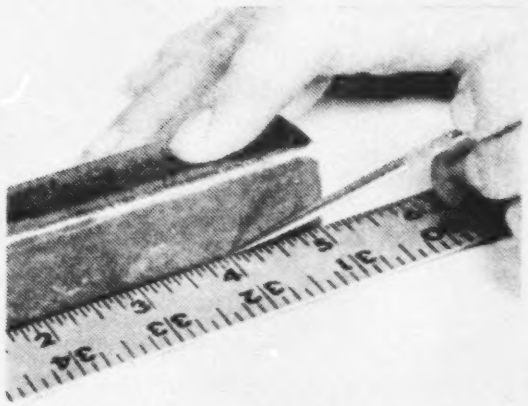
STEP 3 – Place the metal in the vise with the line on top and place the line as close to the vise as possible without cutting the vise with the saw.



STEP 4 Place the saw on the mark

STEP 5 – Cut the metal. Lay the saw down.

STEP 6 – Take the metal out of the vise.



STEP 7 – Mark another piece of ¾" x 1" (1.905 cm x 2.54 cm) rectangular metal 4" (10.16 cm) long.
STEP 8 – Repeat Steps 2, 3, 4, 5, and 6.

Check Point

Check each end of the metal with a square to see that it is cut square. If not, put the metal back in the vise with the end sticking up about ½" (1.27 cm) above the vise.

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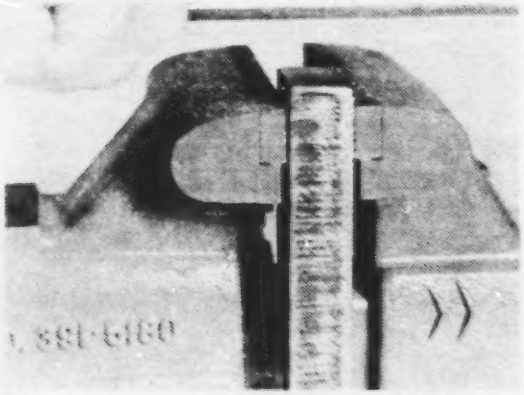
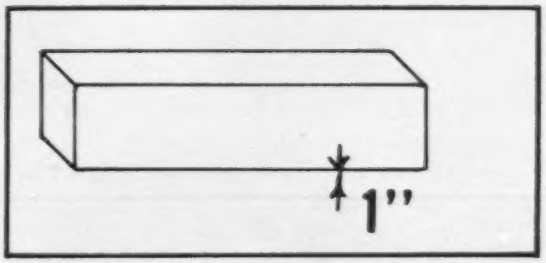
Instructional Objective XI

The student will file, measure, and cut jaws of the clamp.

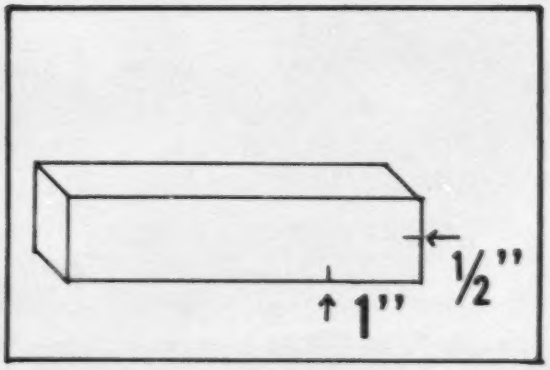


STEP 1 – Pick up the file and file the end of the piece of metal until it is square. Refer to Objective IV on filing.

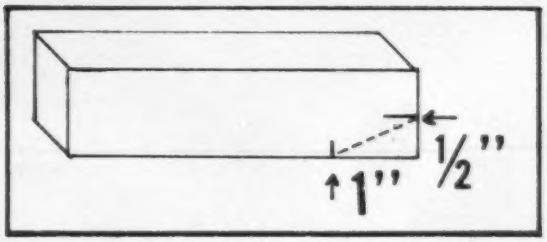
STEP 2 – Repeat Step 1 on the other 3 ends of the 2 pieces of metal.



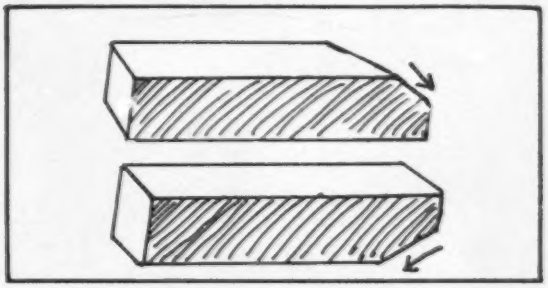
STEP 3 – Pick up one of these pieces of metal and measure from one end 1"(2.54 cm) and mark.



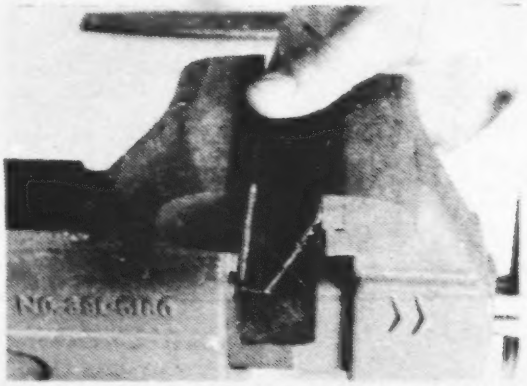
STEP 4 – On the same end measure over ½" and mark it.



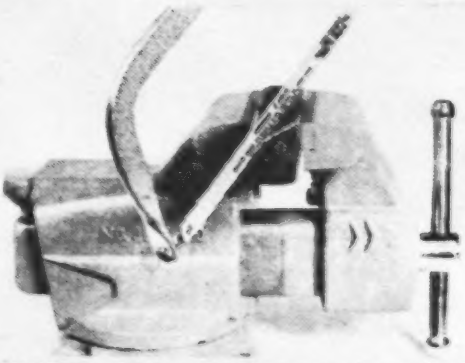
STEP 5 – Using the rule for a straight edge, scribe a mark from the first mark to the second.



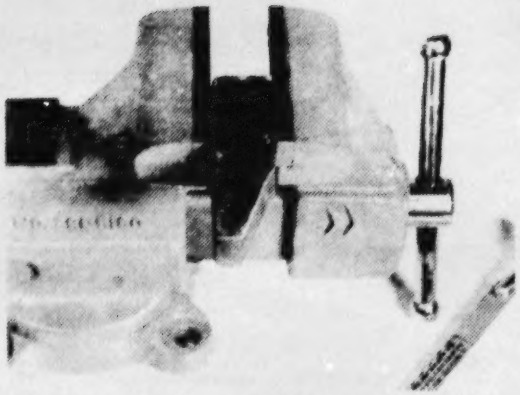
STEP 6 – Repeat Steps 3, 4, and 5 on the second piece of metal.



STEP 7 – Place one piece in the vise with the mark facing up. Locate the metal so the line is outside the jaws of the vise and tighten securely.

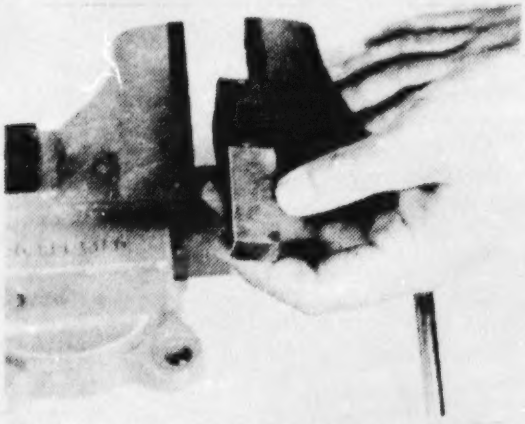


STEP 8 – Pick up hack saw and put the blade on the line.



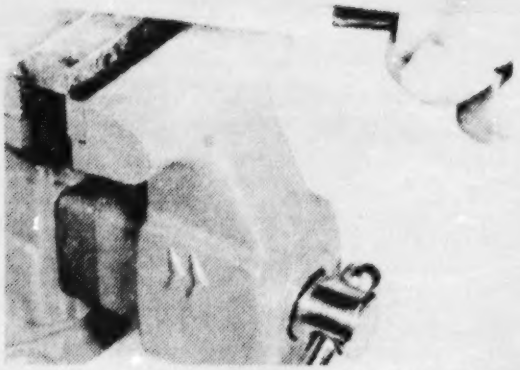
STEP 9 – Cut the metal along this line. When cut is completed, lay saw down.

STEP 10 – Repeat Steps 7, 8, and 9 to the second piece of metal.

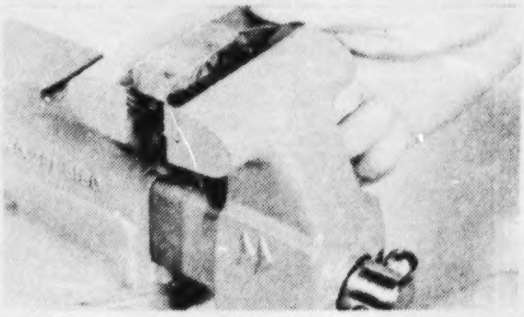


STEP 11 – Take the piece of metal out of the vise and turn it with the cut part facing up.

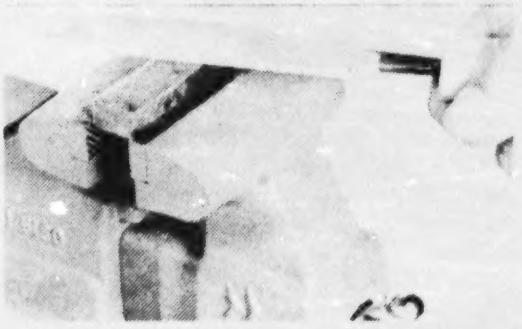
STEP 12 – Put it back in the vise with the cut part up and tighten securely.



STEP 13 – Pick up the file and file the cut smooth and flat. Remove this piece from the vise.



STEP 14 – Pick up the other piece of metal with the cut facing up and put it in the vise.



STEP 15 – Repeat Step 13.

Check Point

Are both pieces equal in size? If not, make the larger piece match the smaller piece.

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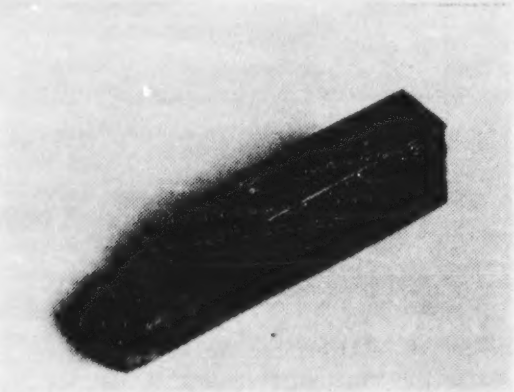
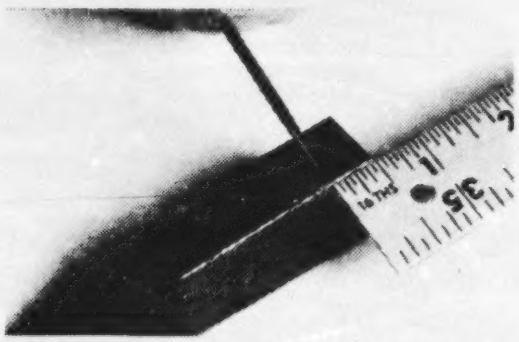
Instructional Objective XI

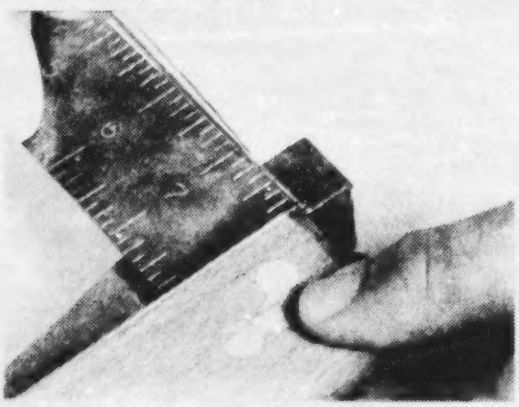
The student will measure and mark the holes for drilling.



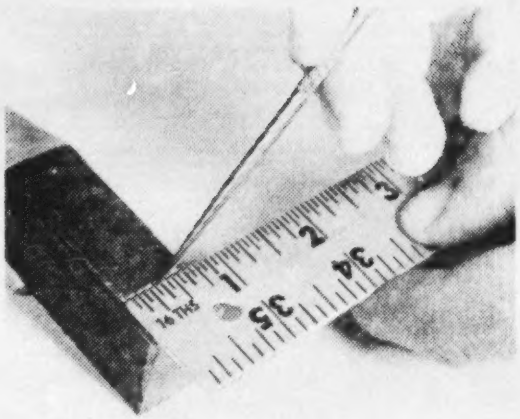
STEP 1 – Pick up one of the pieces of metal and put it on the table with the cut edge facing up.



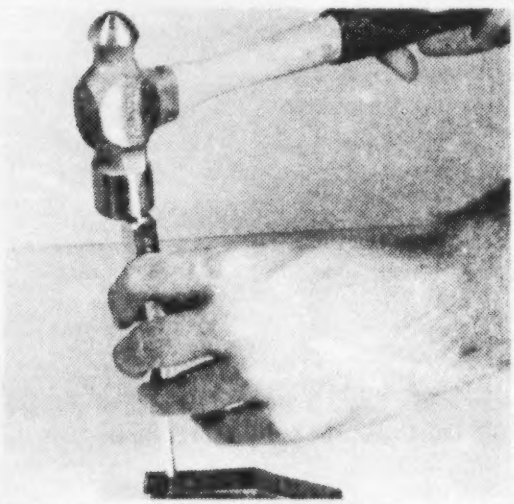
STEP 2 – Pick up the metal rule and from the opposite end of the cut, measure in ½" (1.27 cm) and put a mark.



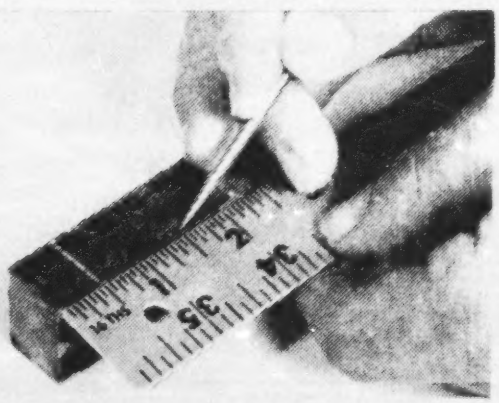
STEP 3 – Using the square, scribe a mark across the metal at this point.



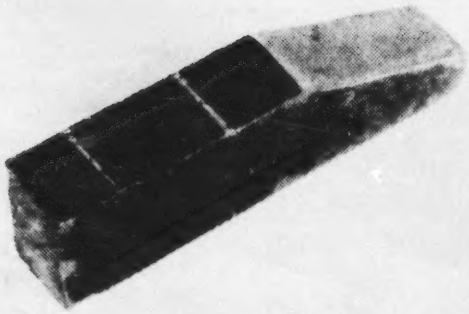
STEP 4 – Take the rule and measure in from the side 3/8" (.9525 cm) on the line and put a mark. This locates the center of the metal.



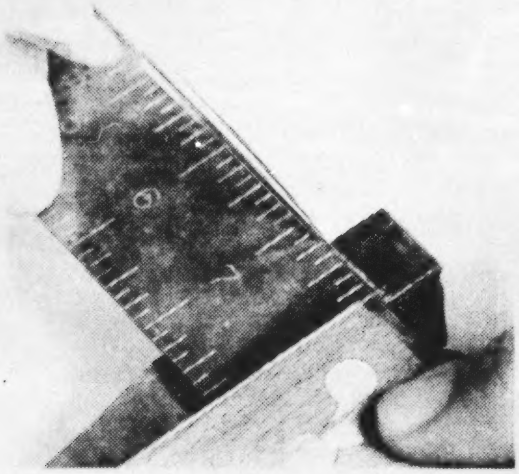
STEP 5 – Pick up the ball peen hammer and punch. Punch the metal where these marks cross. This locates the center of the first hole.



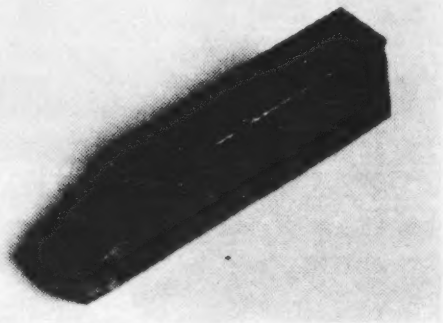
STEP 6 – Using the rule, measure from the same end in 1½" (3.81 cm) and put a mark.



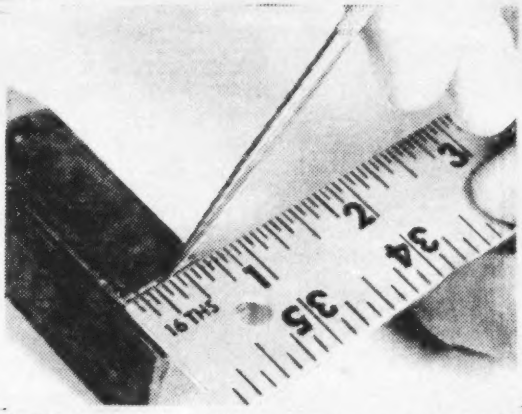
STEP 7 – Repeat Steps 3, 4, and 5. This locates the second hole.



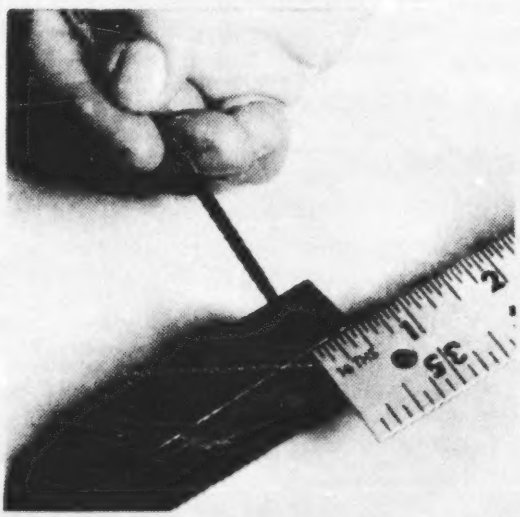
STEP 10 – Using the square, scribe a mark across the metal at this point.



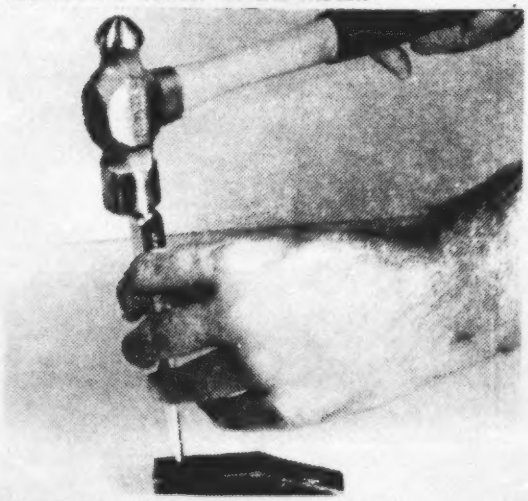
STEP 8 – Place the second piece of metal on the table with the cut edge facing up.



STEP 11 – Take the rule and measure in 3/8" (.9525 cm) on the line and put a mark. This locates the center of the metal.

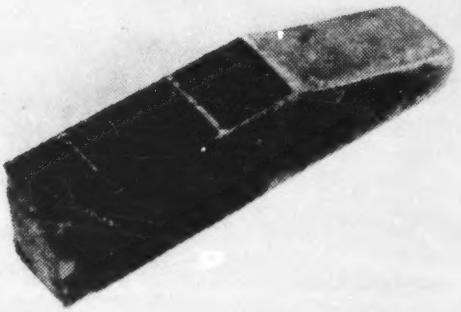


STEP 9 – Pick up metal rule and from the opposite end of the cut, measure in ½" (1.27 cm). Put a mark.



STEP 12 – Pick up the ball peen hammer and center punch. Punch the metal where these marks cross. This locates the center of the first hole.

STEP 13 – Using the rule, measure in from the same end 1½" (3.81 cm) and put a mark.



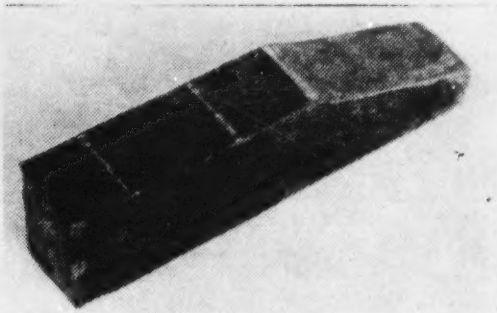
STEP 14 – Repeat Steps 3, 4, and 5. This locates the second hole.

Check Point

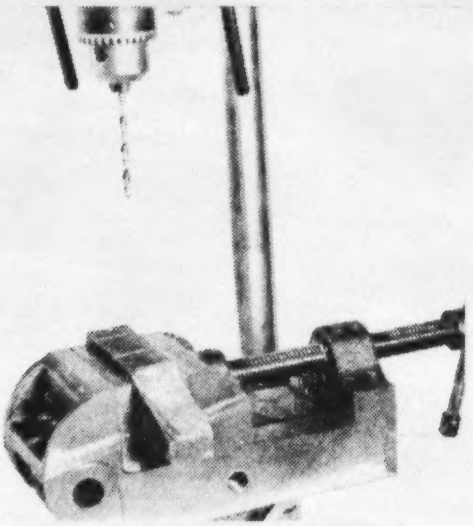
Are all the holes even on both pieces of metal? If they are, proceed to the next Instructional Objective. If not, repeat the last Objective.

Instructional Objective XIII

The student will center drill 4 holes 1/8" (.32 cm) and then redrill the holes 5/16" (.79 cm) and 3/8" (.95 cm).

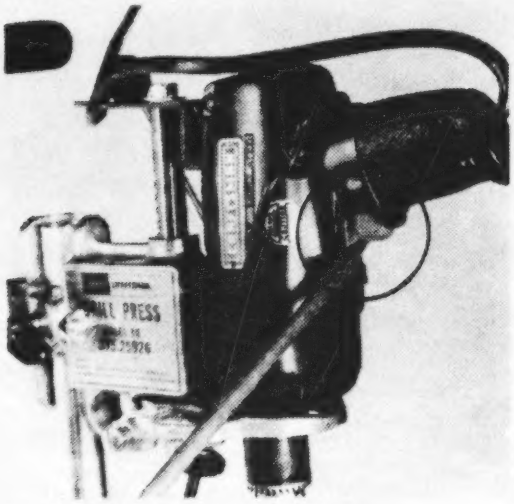


STEP 1 – Put one of the pieces of metal in the vise on the drill press with the marks pointing up and the metal squared to the bit.

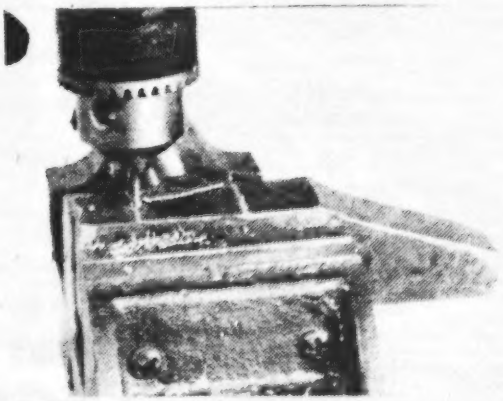


STEP 2 – Using the mark closest to the end of the metal, put the point of the 1/8" drill bit in the punch mark.

STEP 3 – Remember all safety rules which go along with the drill press. Review if needed.

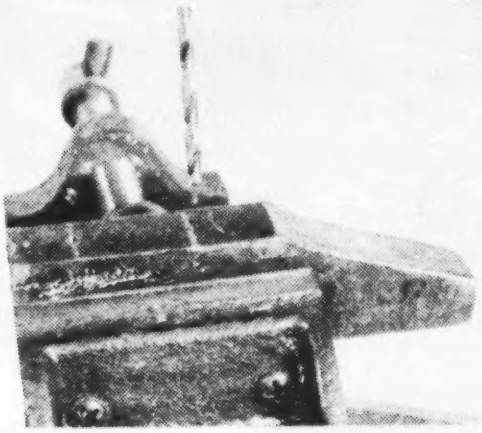


STEP 4 – Grab handle of drill press and turn on drill.

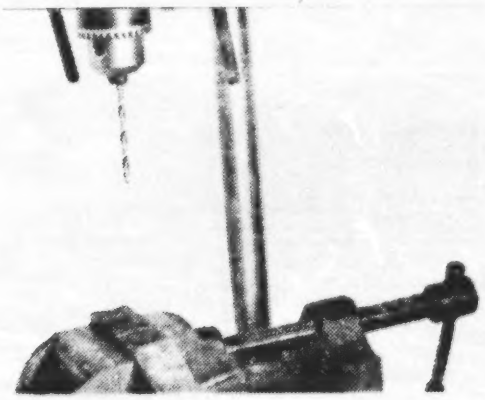


STEP 5 – Drill hole through the metal by pulling down on one arm of drill press.

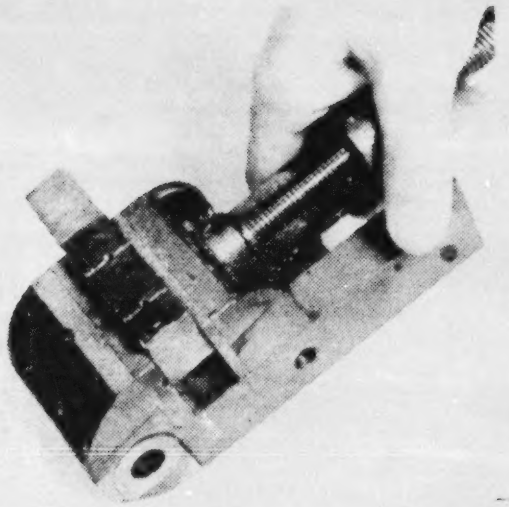
STEP 6 – Let drill handle back up slowly and cut off machine.



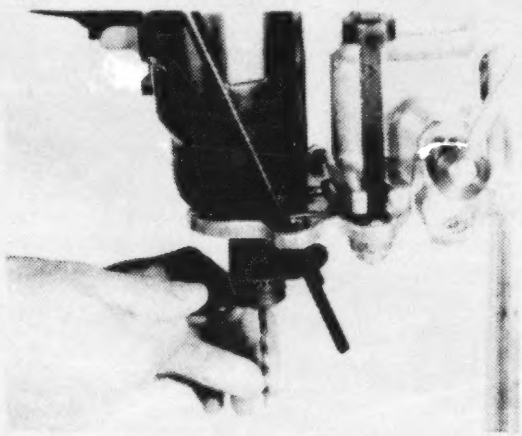
STEP 7 – Drill two marks on metal with 1/8" bit.



STEP 8 – Put the second piece of metal in the vise on the drill press, with the marks pointing up.

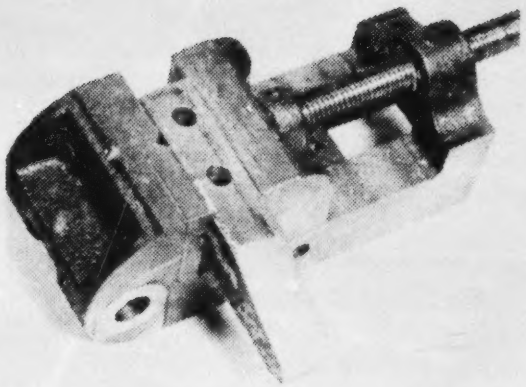


STEP 9 – Repeat Steps 2 – 6 to drill 2 holes 1/8".

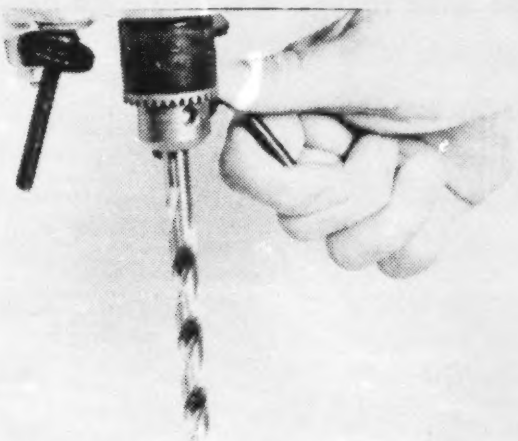


STEP 10 – Remove 1/8" drill bit.

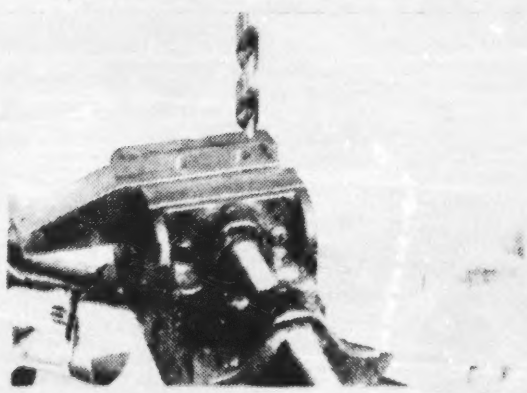
STEP 11 – Put in 5/16" drill bit.



STEP 12 – Drill all four 1/8" holes with 5/16" bit.



STEP 13 – Remove the 5/16" drill bit and replace it with a 3/8" drill bit.



STEP 14 – Using the hole closest to the end of the metal, drill one hole 3/8".

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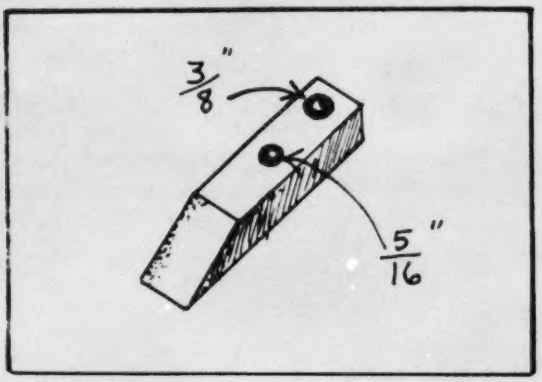
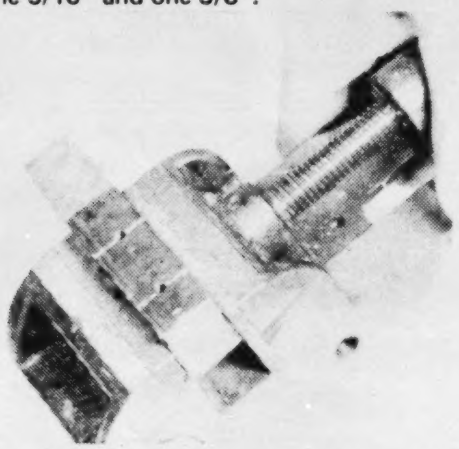
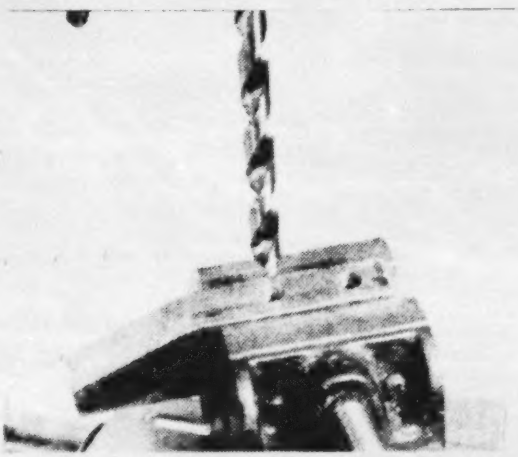


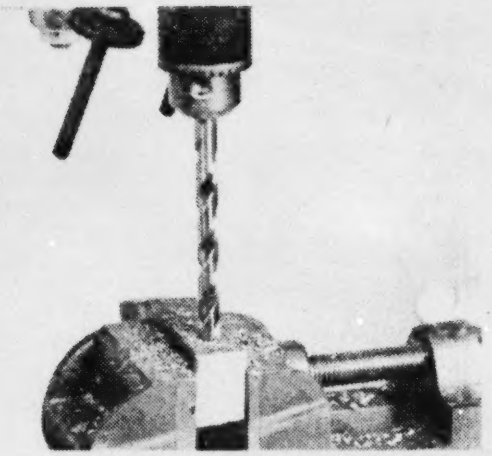
STEP 15 – Remove this piece of metal from the vise. It should have 2 holes drilled through it, one 5/16" and one 3/8".



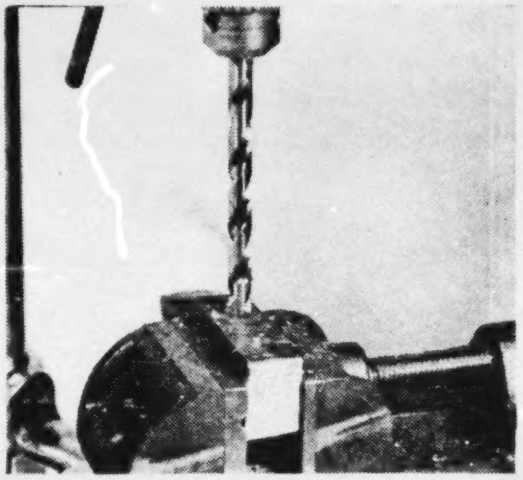
STEP 16 – Place second piece of metal in the vise.



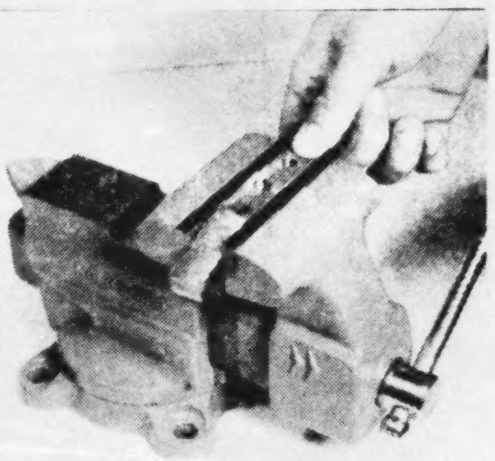
STEP 17 – Line up the 5/16" hole that is 1½" (3.81 cm) from the end of the metal.



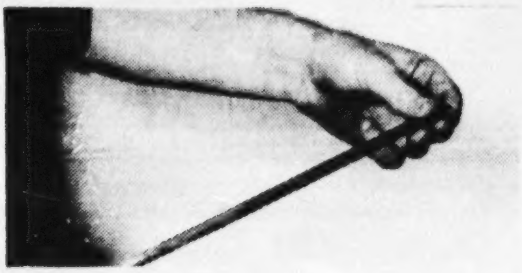
STEP 18 – Drill a 3/8" hole through the metal.



STEP 19 – Remove metal from vise and turn the metal over. See burrs on bottom of each hole.



STEP 20 – Put it in vise with the burrs pointing up.



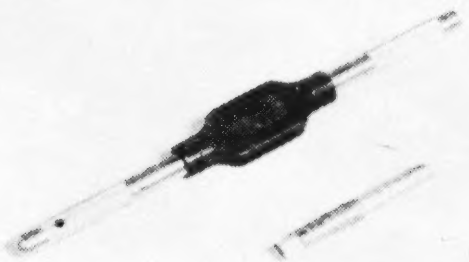
STEP 21 – Using the file, remove the burrs.

Check Point

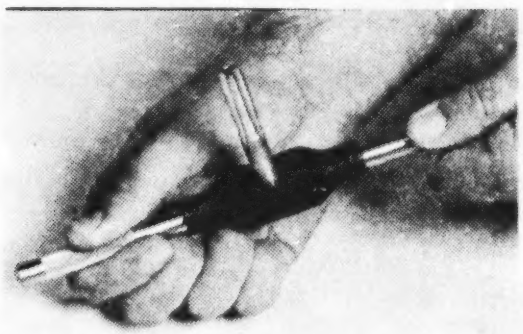
Are all the drilled holes free of burrs? If they are, proceed to the next Instructional Objective.

Instructional Objective XIV

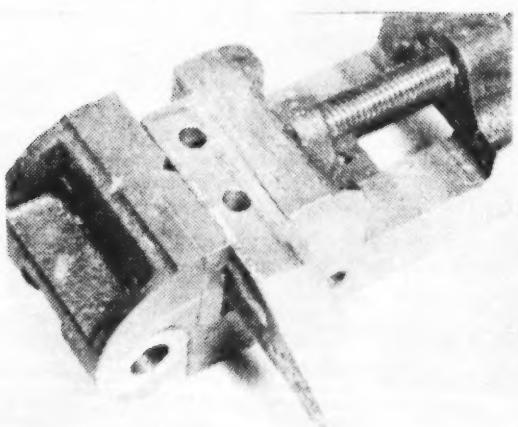
The student will tap a 3/8" (.9525 cm) thread in each of the 5/16" (.79375) holes of the clamp jaws.



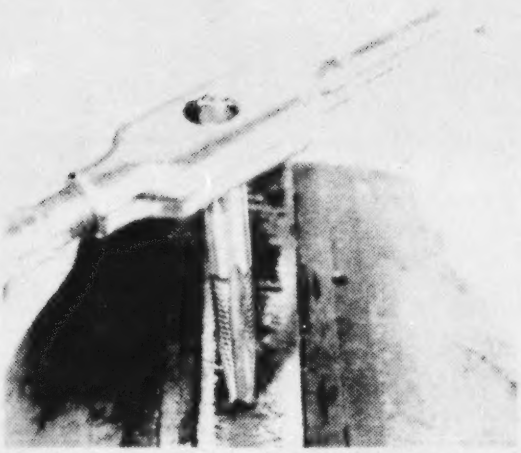
STEP 1 – Take the 3/8-16 tap and handle out of the kit.



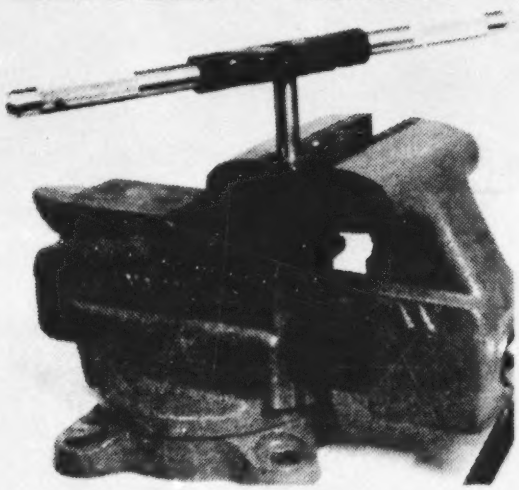
STEP 2 – Put the tap in the handle.



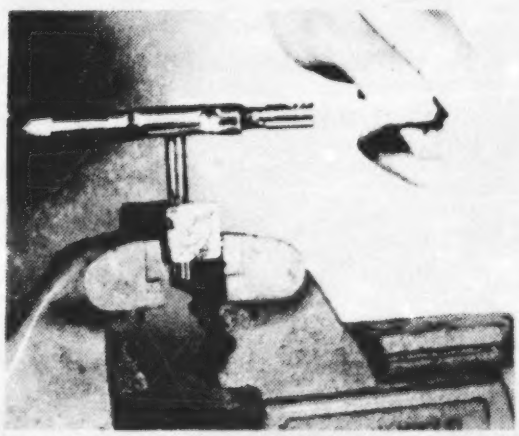
STEP 3 – Put the metal in the vise with the holes facing up.



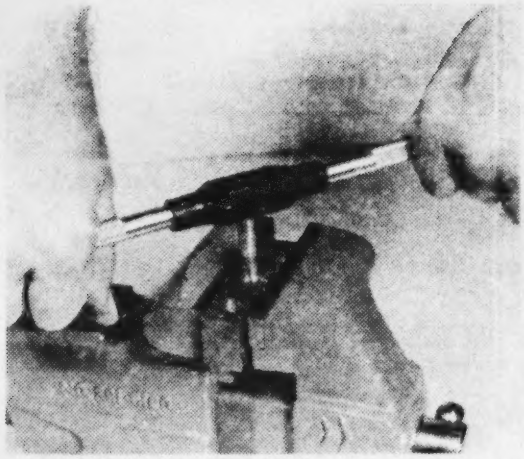
STEP 4 – Set point of tap in the 5/16" hole.



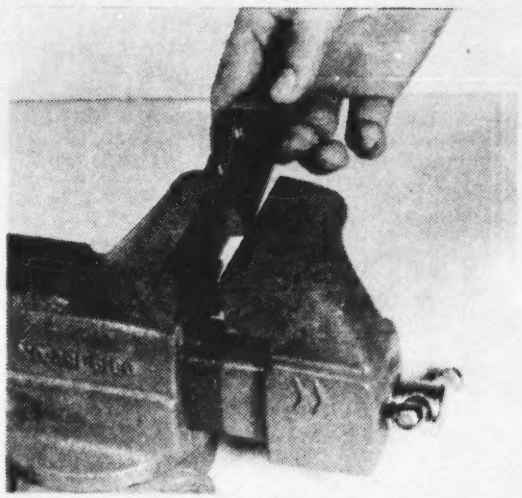
STEP 5 – Start the tap making sure it is straight.



STEP 6 – Continue turning the tap into the metal until the threads are all the way through.

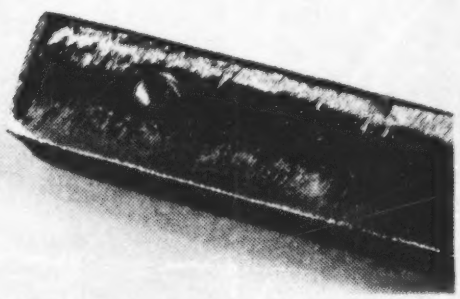


STEP 7 – Back the tap out.



STEP 8 – Take this piece of metal out of the vise and put the other piece in with the holes facing up.

STEP 9 – Repeat Steps 4,5,6, and 7.



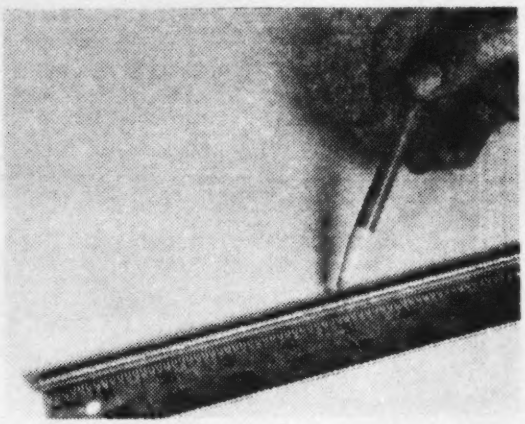
STEP 10 – Take this piece of metal out of the vise.

Check Point

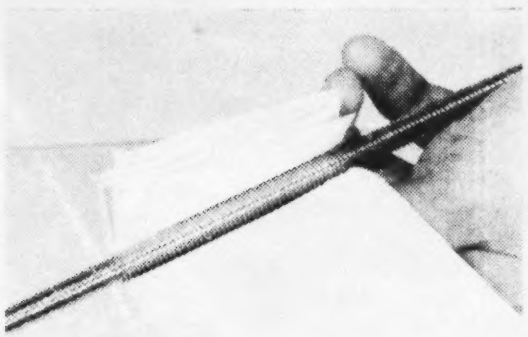
Make sure the threads are neat and clean. Remove all excess metal.

Instructional Objective XV

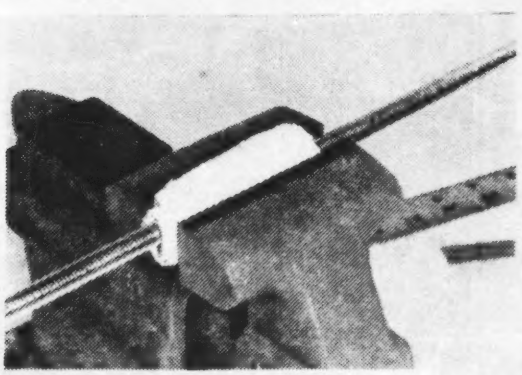
The student will cut two pieces of threaded rod stock.



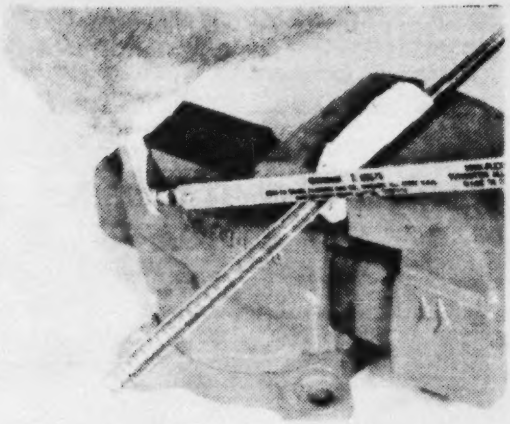
STEP 1 – Get a piece of 3/8" threaded rod and measure 5" (12.7 cm). Make a mark.



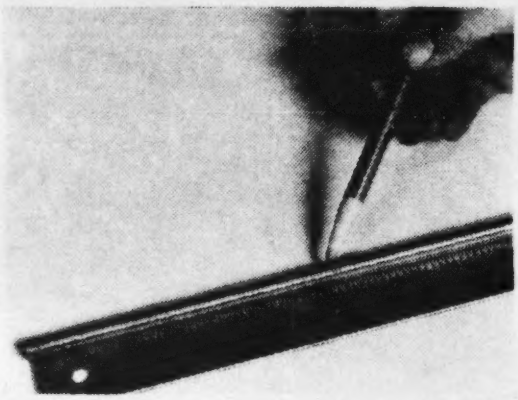
STEP 2 – Wrap metal rod in paper to protect the threads from being damaged by the jaws of the vise.



STEP 3 – Place wrapped metal rod in the vise.

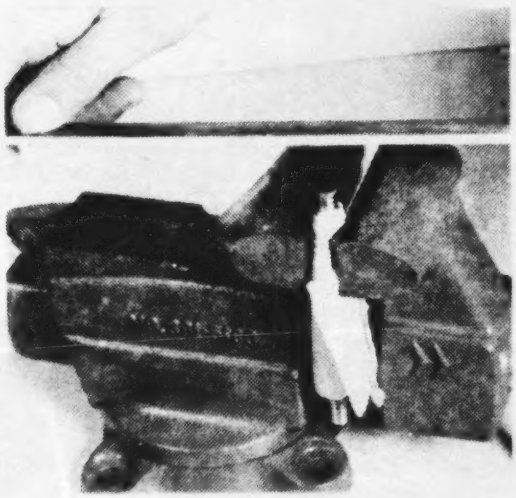


STEP 4 – Cut rod at mark.



STEP 5 – Measure another 3/8" rod 5" (12.7 cm) and mark it.

STEP 6 – Repeat Steps 2, 3, and 4.



STEP 7 – File the 4 ends of these two rods smooth.

Check Point

Are both pieces equal?

If so, proceed to the next Instructional Objective.

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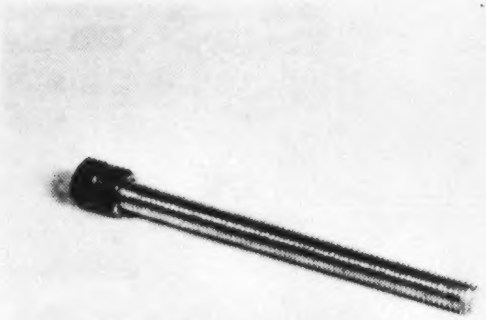
Instructional Objective XVI

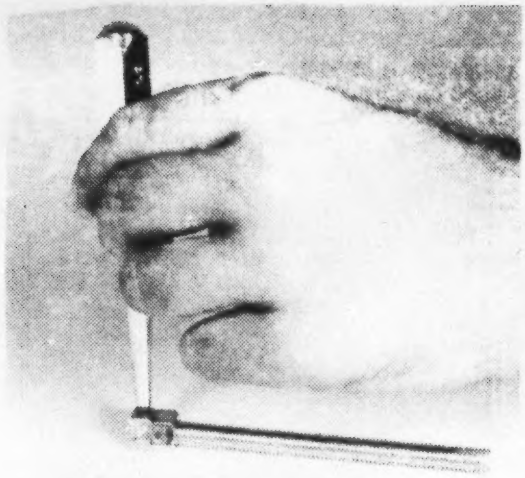
The student will drill a hole through both end nuts on the threaded stock.



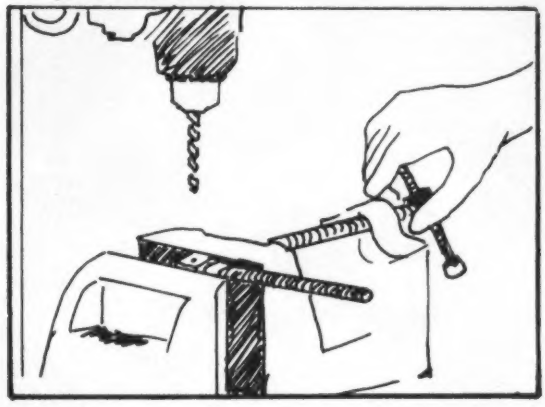
STEP 1 – Put 2 (two) 3/8 - 16 nuts on each of the pieces of rod, with both nuts on one end and threaded in together tight, flush with the end of the rod.

STEP 2 – Get the center punch and hammer.

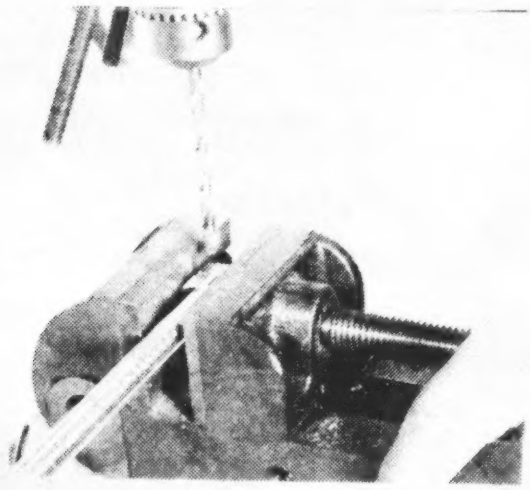
STEP 3 – On one of the flat sides of the end nut, mark the center of the nut.



STEP 4 – Put the center punch on the mark and punch the mark.



STEP 5 – Tighten the nuts in the vise on the drill press. Be sure the punch mark is up.



STEP 6 – line up the punch mark and the point of the 3/16" (.47625 cm) drill bit.

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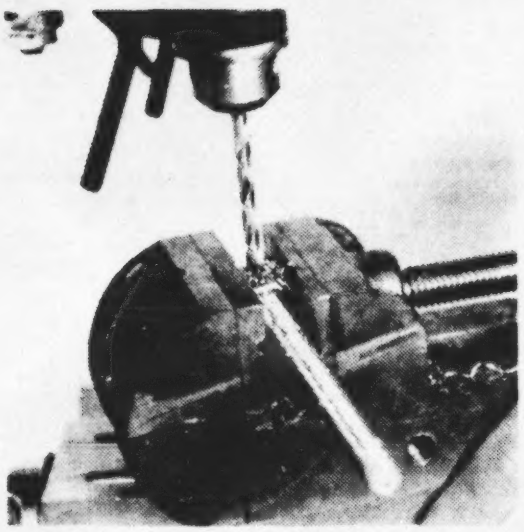
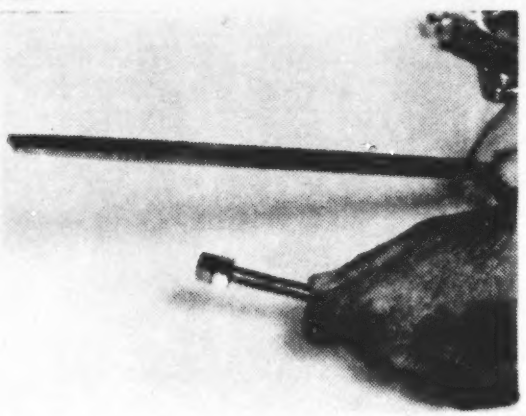


STEP 7 – Drill the hole through the nut and rod.



STEP 8 – Take the nut out of the vise and turn it over. File off the burrs.
STEP 9 – Repeat Steps 5, 6, 7, and 8 for the other rod and nuts.

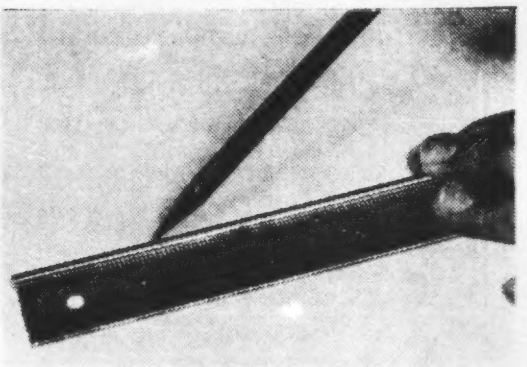
Check Point

Have you drilled holes through both end nuts?

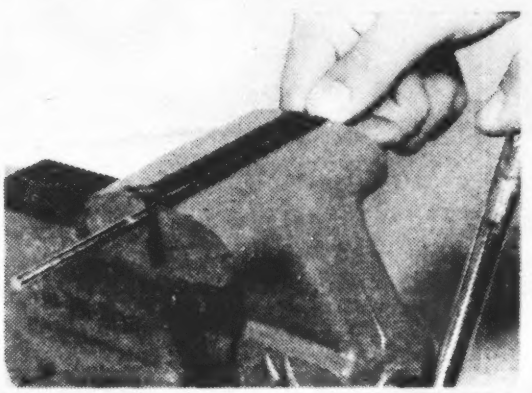
If so, go on to the next Instructional Objective.

Instructional Objective XVII

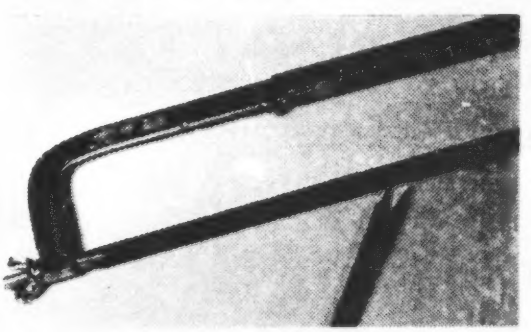
The student will cut 2 pieces of 3/16" (.47625 cm) rod 2" (5.08 cm) long.



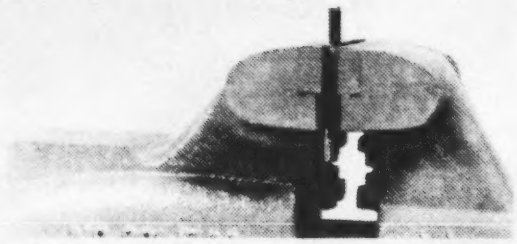
STEP 1 – Measure a piece of 3/16" (.47625 cm) rod 2" (5.08 cm) long. Put a mark.



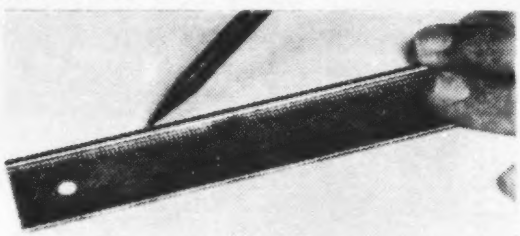
STEP 2 – Put the rod in tehe vise with the rod extending over the side.



STEP 3 – Pick up the hack saw and put it on the 2" (5.08 cm) mark.



STEP 4 – Cut the rod and turn it in the vise so the burrs can be filed off.



STEP 5 – Measure another 2" (5.08 cm) piece of 3/16" (.47525 cm) rod.

STEP 6 – Repeat Steps 1, 2, 3, and 4.

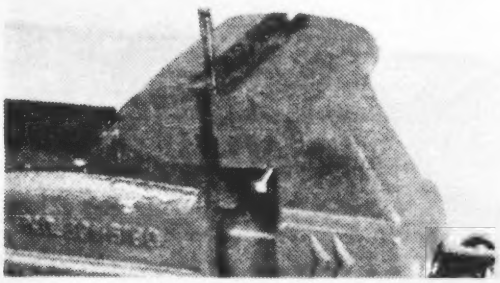
Check Point

Are both pieces equal?

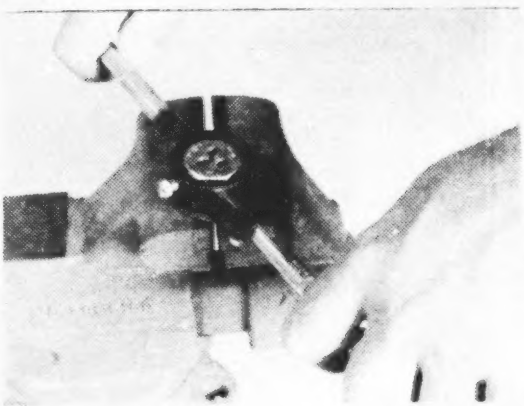
If so, proceed to the next Instructional Objective.

Instructional Objective XVIII

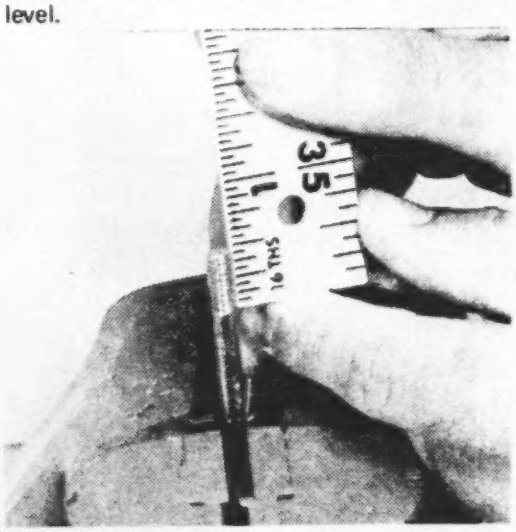
The student will die threads on the 3/16" (.476 cm) rod stock.



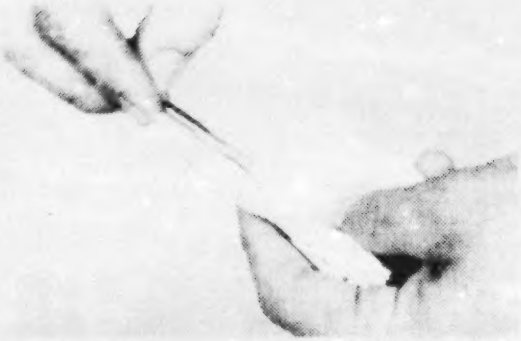
STEP 1 – Put one of the pieces of 3/16" rod in the vise with the end sticking up.



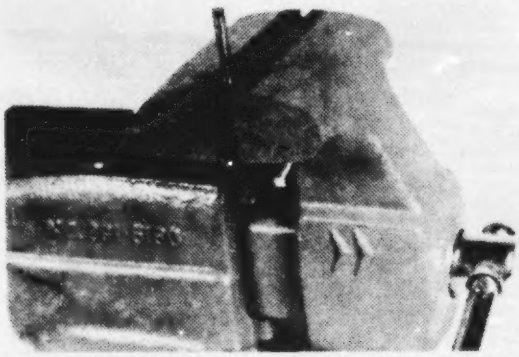
STEP 2 – Start the die on this rod keeping it level.



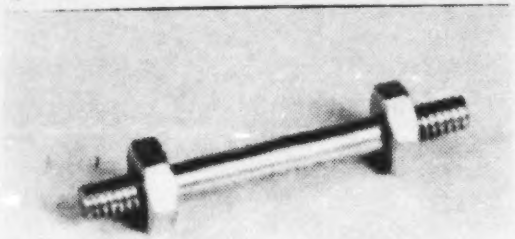
STEP 3 – Thread this rod ½" (1.27 cm). Turn it over and thread the other side ½" (1.27 cm) long.



STEP 4 – Wrap the threads of the rod in a piece of cloth or paper to protect them from the jaws of the vise.



STEP 5 – Take the rod out and put the second rod in the vise. Repeat Steps 2, 3, and 4.



STEP 6 – Put a 12-24 nut on one end of each rod and tighten it.

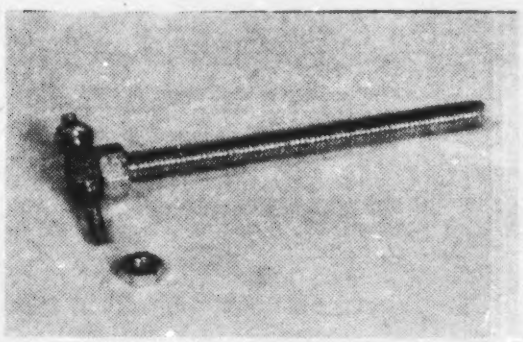
Check Point

Are the nuts tight?

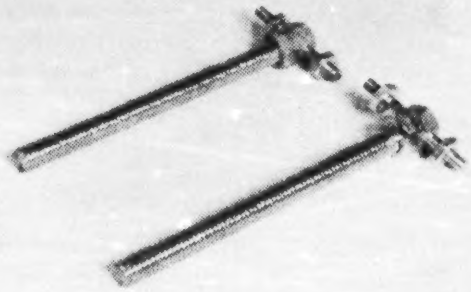
If so, proceed to the final Instructional Objective.

Instructional Objective XIX

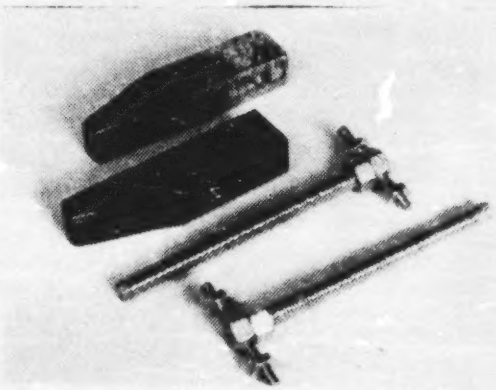
The student will assemble the parts of the C-clamp.



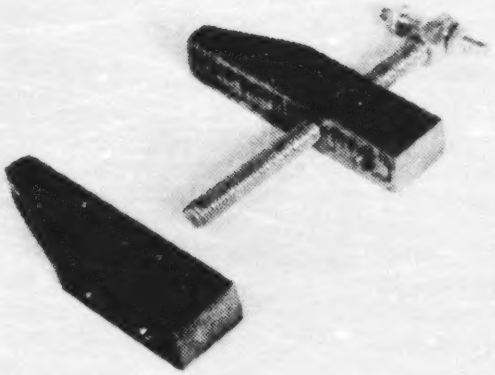
STEP 1 – Slip the 3/16" (.47625 cm) rod through the hole that was drilled through the 3/8" nut and rod.



STEP 2 – Put a 12-24 nut on the other end of the rod. This is the tightening handle for the C-clamp.

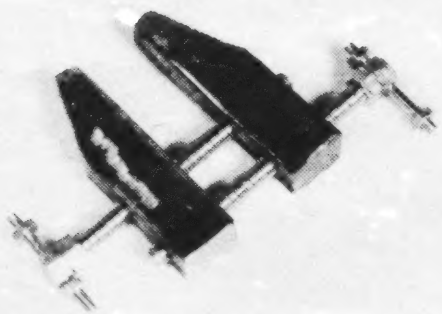


STEP 3 – Repeat Step 2 to the other 3/16" (.47625 cm) rod.



STEP 4 – Assemble all the parts that have been made by referring to the handout distributed by your instructor.

Check Point



Does your C-clamp look like this picture?

Does it operate properly?

606.682-014 DRILL-PRESS OPERATOR (mach. shop) production-drilling-machine operator.

Operates previously setup drilling machines, such as single- or multiple-spindle drill presses to drill, ream, countersink, spot face, or tap holes in metal or nonmetal workpieces according to specifications: Lifts workpiece manually or with hoist, and positions and secures it on machine table in drilling *jig* or holding *fixture*. Moves machine controls to feed tools into workpiece, and engages automatic feed. Observes machine operation and verifies conformance of drilled workpiece to specifications, using fixed gages, calipers, and micrometers. Changes worn cutting tools, using wrenches. Moves controls to adjust cutting speeds, feed rates, and depth of cut. May assist JOB SETTER (fabric. plastics prod.; mach. mfg; mach. shop) in setting up machine. May sharpen cutting tools, using *bench grinder*. May perform minor assembly, such as fastening parts with nuts, bolts, and screws, using power tools and handtools. May be designated according to product as BARREL REAMER (firearms); or function of machine as REAMER OPERATOR (mach. shop); TAPPER OPERATOR (mach. shop).

607.382-010 CONTOUR-BAND-SAW OPERATOR, VERTICAL (mach. shop)

Sets up and operates vertical contour-band saw to cut straight, curved, irregular, or internal patterns in metal or plastic stock, according to specifications, utilizing knowledge of sawing techniques: Reads work order or blueprints to locate cutting layout lines on stock, to determine dimensions and tolerances, and to determine metal to be cut, type of blade to be used, blade tension, cutting speed, feed rate, table angle, and positions of table stops and guides. Relieves saw blade support and drive-wheel tension to change blade and adjust tension. Turns controls to set prescribed cutting speed, feed rate, and table angle. Loosens table stops and guides, using handtools, and positions them to aline and secure workpiece. Places stock on cutting table, either manually or using hoist, and clamps it into position. Cuts saw blade, threads it through hole drilled in stock, welds blade together, using butt-welding attachment, and files weld smooth to cut internal pattern in stock. Starts saw and manually guides stock along layout lines to cut pattern, or engages automatic feed to cut straight line. Turns control to start airflow to blow metal cuttings away from kerf. Verifies conformance to specifications, using ruler, calipers, fixed gages, templates, and micrometers. May take precision cuts, using magnifier to see layout lines. May calculate and mark layout lines according to product specifications. May be required to have experience with particular product or size, type, or trade name of machine.

600.280-022 MACHINIST (mach. shop) machinist, all-around; machinist, first class; machinist, general; machinist, precision.

Sets up and operates machine tools, and fits and assembles parts to make or repair metal parts, mechanisms, tools, or machines, applying knowledge of mechanics, shop mathematics, metal properties, and layout and machining procedures: Studies specifications, such as blueprint, sketch, damaged part, or description of part to be replaced, to determine dimensions and tolerances of piece to be machined, sequence of operations, and tools, materials, and machines required. Measures, marks, and scribes dimensions, and reference points to lay out stock for machining [LAY-OUT WORKER (mach. shop)]. Sets up and operates metal-removing machines, such as lathe, milling machine, shaper, or grinder, to machine parts to specifications. Verifies conformance of workpiece to specifications, using measuring instruments [TOOL-MACHINE SET-UP OPERATOR (mach. shop)]. Positions and secures workpiece in holding device, such as chuck or collet, or on surface plate or worktable with such devices as vises, V-blocks, and angle plates, and uses handtools, such as files, scrapers, and wrenches, to fit and assemble parts to assemblies or mechanisms. Verifies dimensions and alinement with measuring instruments, such as micrometers, height gages, and *gage blocks*. May operate mechanism or machine, observe operation, or test with inspection equipment, to diagnose malfunction of machine or to test repaired machine. May perform flame cutting and arc or gas welding operations, when required. May develop specifications from general description and draw or sketch product to be made.